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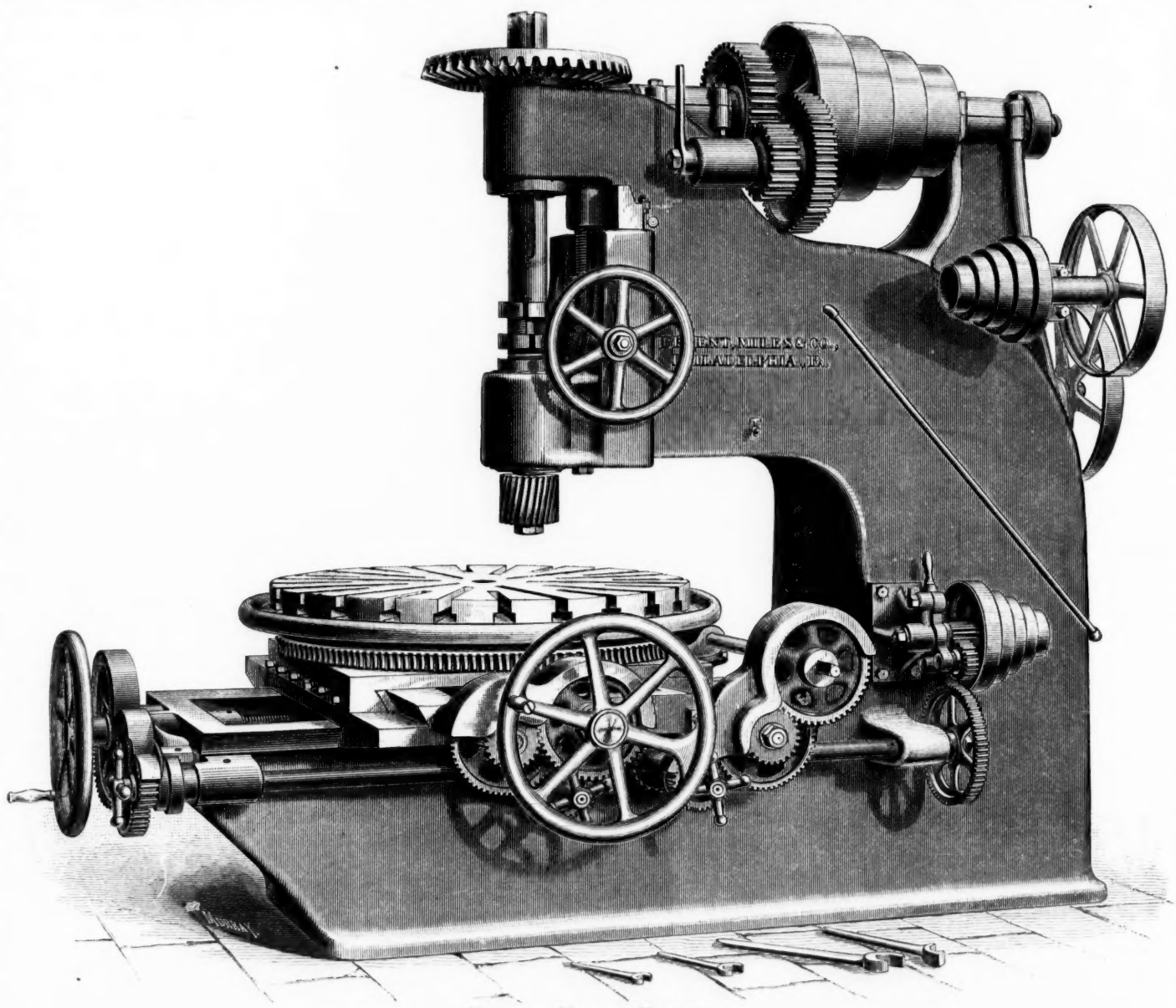
Vertical Milling Machine.

In a great variety of operations upon metals, formerly altogether performed with planing and shaping tools, the use of milling cutters has become very general, producing better and more uniform work with great economy.

For many purposes a machine is required in which work of large dimensions can be milled around its entire edge, in curved or straight lines and at all angles, as well as on portions of its upper surface. Such is the vertical milling machine built by Bement, Miles & Co., Philadelphia, and illustrated by our engraving.

The spindle has eight changes of speed by a cone and back gearing, which give ample power and range of speed for large and small cutters. Its lower bearing is upon a counterbalanced vertical slide, which is controlled by screw, gearing and hand wheel. The cutter is thus capable of a vertical movement of 10 inches. As the steadiness of the cutter depends much upon these parts, their wearing surfaces are large and the means of adjustment complete. Provision is made for drawing the cutter mandrel tightly into its place, as well as for removing it from the spindle without the use of a hammer. The center of the cutter is 32 inches from inside of frame.



VERTICAL MILLING MACHINE.

The table is 42 inches in diameter, and has circular and right angular movements, the latter of 28 and 33 inches respectively, all reversible and self-acting with five changes of speed or operated by hand.

In cutting steel or wrought iron a liberal supply of some lubricating liquid is required. This is drawn from a tank in the interior of the upper part of the frame through nozzles to which pipe and hose may be attached. It drains into a wide gutter surrounding the table, and through suitably arranged openings into a settling tank in the lower part of the frame. A pump, not visible in the engraving, driven from the countershaft, then raises it to the upper tank to be used again.

The strength and stiffness of all parts of the machine enable it to do work rapidly and well.

A Lively Boiler Explosion, With a Cause.

A correspondent sends us an account of a boiler explosion in Evansville, Ind., accompanied by photographs of the wreck. The boilers, there was a battery of three, he claims were perfectly safe if they had been in good hands.

He writes: "The back end of one of the boilers was found about 500 yards from the mill, top of what is called the coal mine hill, and at an elevation of about 100 feet. The front end of one of the boilers sailed over the river, just missing the pilot-house of a steamer, and landed high and dry on the Kentucky side, at least 1,000 yards from the mill." An eye witness says: "The dome went straight up at least 400 feet; it landed about 10 steps from the boiler. * * * * The fireman, poor fellow, was killed. * * * * Out of all three boilers no two sheets can be found together. Small pieces can be found in every direction. All this destruction was caused by a blockhead of a machinist left in charge, who had made application to join the N. A. S. E., but had been rejected from incompetency. Unfortunately the blockhead escaped unhurt." Altogether our correspondent details a lively time, caused by incompetency, as is almost invariably the case.

Early Engineering Reminiscences.

BY GEORGE ESCOL SELLERS.

TWENTY-EIGHTH PAPER.

The machine I referred to, believing it to have been the first machine on this Continent to make continuous paper, and that I had a perfect recollection of, was in the paper mill of Mr. Thomas Gilpin on the Brandywine Creek a few miles from Wilmington, Del., but I cannot with certainty fix the date that I first saw it in operation; but from other circumstances connected with the visit to the mill with my father I do not think it was earlier than 1817 or later than 1818, and then the machine had been in operation for a considerable time. I have no distinct recollection of the special object of my father's visit to the mill at that time. But I do remember that he and Mr. Gilpin and his manager, Mr. Greatrake, spent much time in the machine room watching the operation, sketching and discussing points in connection with the forming cylinder and the exhaust pumps. The millwright had been called in, and while some changes were being discussed I left them; having considerable portion of the afternoon to myself I took advantage of it to call on Mr. Irene Du Pont, the founder of the Du Pont Powder Mills, whom I had frequently met in my father's office; he took me through the mills explaining everything; this made a lasting impression, for it was the first time I had seen the process of gun-powder making. I also visited the cotton factory of my father's old friend, Mr. William Young, who had, in connection with his factory, a good machine shop for that period. It was in this shop that my uncle, Franklin Peale, served his apprenticeship, and who afterwards became the chief coiner of the U. S. Mint, and the inventor of the steam coining press, which he constructed and put into practical operation. I had the gratification of witnessing the first coin struck by it, and of being one of the select few invited to witness the first steam coinage on March 23d, 1836, and still have in my possession one of the coins, or rather, I should say, one of a few that were struck a few days previous when my uncle was adjusting the press, testing its capability, and also the dies. This test was only in the presence of Dr. R. M. Patterson, the then director of the U. S. Mint, Adam Eckfeldt, the old and first coiner of the U. S., Mr. Gobrecht, the die sinker, Jos. Saxton and myself. Of those present at the select exhibition on the 23d, I recollect Matthew W. Baldwin, Rufus Tyler, Wm. Mason, S. V. Merrick, and S. Morris, as among the most prominent mechanics of the time. The dollar press went into operation the fall of the same year, 1836. I have one among the first that were struck. It bears that date, and has the die sinker's name, C. GOBRECHT, F., in very small sunken letters under the figure of the Goddess of Liberty, thus perpetuating and passing to posterity in letters that will remain when all the raised ones are worn away, not the name of Thomas Sully, the artist who designed the figure of the goddess, but the copyist who only reproduced it, when the name of the artist as well as that of the creator of the unerring press that struck the coin is lost.

But all this has nothing to do with paper making or paper making machinery. We

spent the evening with Mr. Gilpin in his bachelor quarters, Messrs. Du Pont and Greatrake being of the party. The making of paper by machinery in all its aspects was discussed, also the feasibility of drying the paper by steam heated cylinders. To the best of my recollection Mr. Gilpin expressed great doubts, fearing injurious effects on the paper. He had a scheme of drying by passing the paper from the machine through chamber currents of heated air, the paper being carried on rack belts, partially drying, then passing between heated calender rolls, thence through another long chamber of air heated to a higher degree, and finishing by a second set of calender rolls. I have no knowledge of his ever having essayed to put this plan in practice, though he seemed to have tested the degree of heat, length of chambers, speed of paper, and velocity of the current of heated air necessary to produce the results aimed at.

The Gilpin machine was that of John Dickinson. The original cylinder was made in England and brought out by Mr. Greatrake who had been foreman of Dickinson's "Mash Mill." My impression is that the rest of the machine was constructed at a machine shop erected for that purpose at the mill. For many years the machine was worked with as much secresy as Dickinson had worked his in England. The cylinder was not over 3 feet and about 2 feet in diameter, a solid brass casting bored perfectly smooth interior, and the outside was turned in shallow grooves leaving between them ridges with sharp edges corresponding to the bars of paper moulds. In the grooves between the ridges holes were drilled into the interior of the cylinder so close together as to form a perfect net work, through which the water from the pulp passed into the interior of the cylinder; the sharp edges of the ridges that separated the grooves were notched lengthways of the cylinder about $\frac{1}{4}''$ apart to receive rods of about No. 16 hard brass wire, that was soldered into the notches, forming an underface like the underface of a paper mould. Over this was a backing of wove wire of about 14 meshes to the inch, on which the fine wire cloth face was placed. The ends of the cylinder were closed with solid brass plait heads having journals cast to them on which the cylinder turned. One of these journals was hollow, through which a tube passed into the bottom of a V-shaped trough with closed ends, the edges of the trough coming into close contact with the inside of the cylinder, which it was held firmly against by having a journal opposite to the tube end and centering in the solid journal of that end of the cylinder. The dilute pulp being delivered to the cylinder by pumping out the water and partly exhausting the air from that portion of the cylinder covered by the space between the edges of the V-shaped trough, the exterior atmospheric pressure sufficiently consolidated the film of pulp to prevent it squashing and disfiguring the paper as it passed under and on to the felt of the couching roll, and thence between the various press rolls. This V-shaped trough, in which the amount of exhaust could be regulated, was the great feature of the Dickinson cylinder machine, and was deemed essential.

The manner of reeling the wet paper was ingenious. To prevent any undue strain that would tear the wet paper asunder, the reels were driven by the friction of a wooden V-edge wheel in a corresponding V-lined with leather wheel on the reel shaft, the amount of traction being regulated by a P. weight sliding on a lever arm that pressed the wheels together. The reels were formed of six wooden slats on spider arms. One of the slats had a groove from end to end in which a knife was run cutting outwards. Thus when the required quantity of paper was wound on the reel, separating it and allowing it to fall on to a sliding table from which the porter separated the sheets, carrying and hanging them in the drying loft. To prevent loss of time in changing the reels and cutting the paper loose from them, two reels were hung at opposite ends of center-pivoted arms. Mr. Gilpin had attached to each reel a counter with dial showing the number of revolutions or sheets wound. When a reel had on it the number of sheets required, the attendant would swing it over without stopping the paper being formed, and as soon as the empty reel had taken the place of the full one he would, with a stick, break down the wet paper pressing the end between the slats of the empty reel, and the winding would continue on it. Mr. Gilpin complained of the necessity of having so many different sizes of reels, or being obliged to change slats to suit the different sizes of paper ordered; I asked why not make the reels to expand and contract to adjust for the different sizes? He turned to me and in his quick, impulsive manner, said: "Boy, that is easier said than done. I have often thought of it but I cannot see any way of accomplishing it." His sudden explosion almost took my breath from me; I felt as a boy, I had been too hasty in putting in my oar. I stammered: "If you will come to our shops, and see grandfather's old sieve hoop rounders or stretchers, they may give you an idea." These old stretchers were nothing more than a plate scroll screw, that, on turning, thrust out a number of arms against the inside of a sieve hoop holding it to a perfect circle, while the wire cloth was being tacked on—the same in principle as the present universal lathe chuck. It was not long until Mr. Gilpin came to see the stretchers, and was so well pleased that he undertook to have a couple of six-arm expansive reels made. At that time there was no face lathe in Philadelphia with arrangement for cutting the scroll screw. He had recourse to Isaiah Lukins, who wound a wrought-iron scroll thread, riveted and brazed it on to a wrought plate in the same manner grandfather had made his original stretchers. Mr. Gilpin was very proud of these reels, so much so that he had a graduated scale with vernier attached, that enabled him to at once adjust for any length of paper; this, with his counters and their registers, he considered a great advance, but they were to be superseded by steam dryers, calenders, slitters, and cutters to deliver the finished sheets direct from the machine.

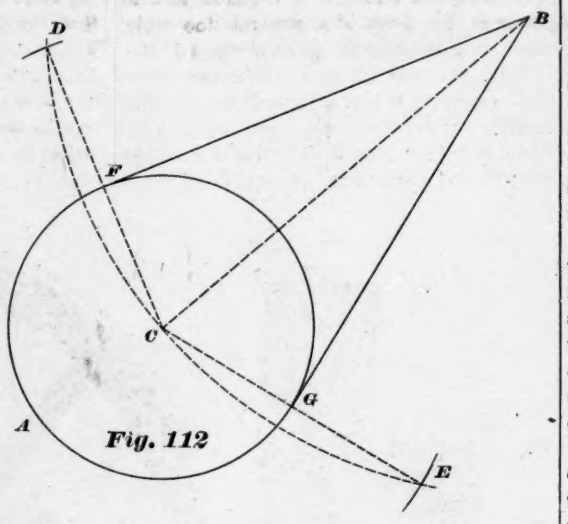


Fig. 112

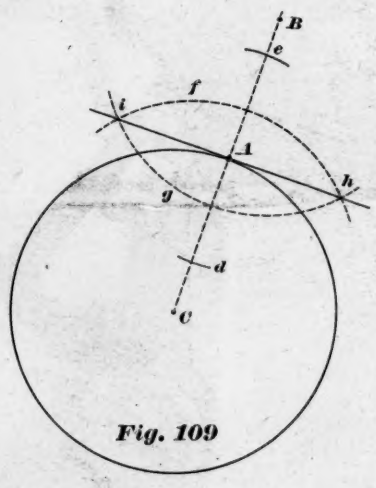


Fig. 109

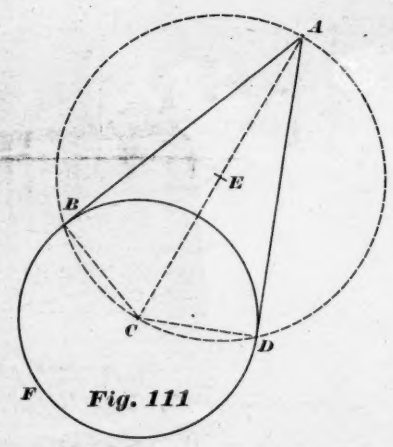


Fig. 111

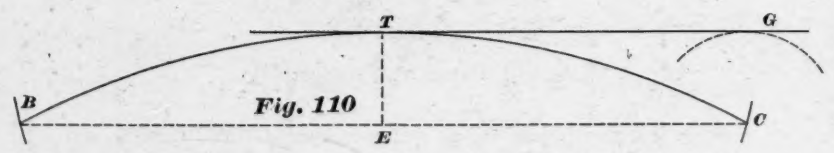


Fig. 110

Sometime previous to the visit of Mr. Gilpin's mill a very simply constructed cylinder was brought to be covered with wire cloth. I cannot recall the name of the Frenchman who brought it nor the location of his mill except that it was in New Jersey, and that it was a hand mill making wrapping and sugar loaf paper. It was a small affair, not over 2′ 6″ long and about 2′ diameter. It was constructed on the principle of a squirrel cage wheel. Six slender arm brass wheels on an iron shaft that was covered with a copper tube formed the frame work of the cylinder. The end wheels had rims about $1\frac{1}{2}''$ deep by $\frac{1}{2}''$ thick, and at their smallest diameter a projecting rim or collar about 1″ not over $\frac{1}{4}''$ thick at its outer edge. The four center supporting wheels equally spaced on the shaft had round rims of about $\frac{3}{8}''$ diameter. Holes were drilled close to the outer edge of the end wheels about 1″ apart of a size to take in a No. 6 brass wire through these holes. Brass wire rods of that size were run from end to end of the cylinder, resting on and being supported by the round rims of the intermediate wheels. This was the condition of the cylinder when it was brought to the shop of N. & D. Sellers to be finished and faced with wire cloth by its inventor and maker, and I recollect it as a very creditable piece of work. The rims and collars of the end wheels were accurately turned the arms and hubs finished, as were also those of the supporting wheels whose round rims were turned as much as they could be beyond the arms, the portions between the arms file and scraper finish. The man had worked out in his own mind exactly what he wanted done. In the first place the longitudinal rods must be secured to the round rims of the supporting wheels so as to keep them straight and equal distance apart; this he proposed doing by tieing to rim with soft copper wire. It was done by the kind of loop sewing as wire screens were then made. This being done the cylinder was wrapped from end to end with No. 18 hard brass wire laid so as to leave a space of $\frac{1}{4}''$ between each round. This was secured to the longitudinal rods in the same manner of loop sewing as they were secured to the rims of the supporting wheels, then covered as the Gilpin cylinder was by a wove brass wire backing of 14 meshes to the inch, over which the fine wire face was placed.

The explanation given of the object of the projection rims or collars on the ends of the cylinder, was that the cylinder was to be sunk, to say, $\frac{2}{3}$ or $\frac{3}{4}$ its diameter in a vat of dilute pulp, these collar projections coming into close contact with the sides of the vat. By tacking a strip of sheep skin with the wool on it to the vat, so that the wool would rest on the collars, and by their intercepting the pulp would form a pulp tight joint, and allow the cylinder to revolve with very little retarding friction. Holes through the vat near the bottom inside of the cylinder led into an outside vat into which the water from inside the cylinder could freely pass; in this outside vat he had a Persian wheel, that by revolving would raise the water to its hollow center axis, through which it poured back into the pulp vat, only allowing so much to escape through an adjustable gate as would correspond to the amount of water coming in with the constant supply of pulp. By regulating the speed of the Persian wheel, the difference in the height of dilute pulp outside and the water inside the cylinder would be kept uniform with sufficient difference to consolidate a film of pulp to pass into the felt of the coucher without squashing.

I have no knowledge of what experiments have been tried, but from the confidence the man spoke on that head, it gave the impression that he spoke from actual trial results. There must have been difficulties he met with in getting his machine into successful operation, for it was a considerable time before he sent specimens of a very fair quality of printing paper made on the cylinder.

I have been thus particular in describing this cylinder, for I believe it to have been the first simple squirrel wheel cylinder ever made; and also on account of its close resemblance to the cylinder invented and patented by John Ames, of Springfield, Mass., at a later date, and from which patent grew long and expensive litigation.

I recollect that when my father sketched and explained this simple cylinder to Mr. Gilpin that he seemed perfectly incredulous as to the possibility of consolidating a film of pulp sufficiently to couch without the V-trough and exhaust pumps, but at the same time he showed considerable uneasiness; for, said he, could such a simple cylinder and machine be made to work at all it would be a dangerous competitor to his expensive cylinder machine.

Practical Drawing.

By J. G. A. Meyer.

THIRTEENTH PAPER.

Problem 15.

144. THROUGH A GIVEN POINT IN THE CIRCUMFERENCE OF A CIRCLE TO DRAW A TANGENT.

Fig. 109. Let *A* be the given point in the circumference, it is required to draw through the point *A* a straight line which shall be tangent to the given circle.

Through the center *C* (Fig. 109) and the given point *A* draw a straight line *C B*. From the point *A* as a center and with any radius draw two short arcs intersecting the line *C B* in the points *d* and *e*. From *d* as a center and with a radius greater than half the distance between the points *d* and *e* draw an arc *f*; from the point *e* as a center and with the same radius describe an arc *g* intersecting the arc *f* in the points *i* and *h*. Through the points *i* and *h* draw a straight line; this line will pass through the point *A*, and is the tangent required.

In geometry it is proved, that a tangent to a circle is perpendicular to a line drawn through the center of the circle and the point of contact or point of tangency; or in other words, the tangent is perpendicular to a radial line drawn through the point of tangency. Therefore in the commencement of a construction of this kind, a line through the center of the circle and the point of tangency must be drawn.

By examining the construction in Fig. 109, it will be seen that we have drawn through the given point *A* (which is the point of contact or the point of tangency) a line perpendicular to the radius previously drawn through the same point of contact. The method for drawing the perpendicular is the same as explained in article 103.

To the student it may seem, that, drawing a tangent through a given point in the circumference of a circle is such a simple matter, which any one can or should be able to accomplish by holding a straight edge close to

the point *A*, and then draw a line along the edge; and therefore a construction as shown in this article is altogether unnecessary. But by a little reflection he will learn, that without this geometrical construction incorrect results will follow, as a straight edge can be held on the point *A* in a seemingly correct position, and yet be considerably out of the true direction, particularly so when the diameter of the circle is small.

145. Sometimes the center of the circle, to which a tangent is to be drawn, is inaccessible; in such cases we must adopt the following method:

Let *B T C*, Fig. 110, be an arc of a circle whose diameter is very large, and *T* the given point in this arc, it is required to draw a tangent through the point *T*.

From the point *T* as a center and with any radius describe two short arcs intersecting the arc *B T C* in the points *B* and *C*. Join the points *B* and *C* by a straight line. Through the point *T* draw a straight line *T G* parallel to the straight line *B C*; the line *T G* will be the tangent required.

146. If this tangent is to be drawn on the floor and is very long, then instead of adopting the method for drawing a line parallel to another as given in Art. 113, proceed in the following manner.

Fig. 110. Through the point *T* draw a straight line, *T E*, perpendicular to the line *B C*, and cutting it in the point *E*. From the point *C* as a center, and with a radius equal to *T E*, describe a short arc, *f*. Through the point *T*, draw a straight line, *T G*, which will also be tangent to the arc *f*; or, in other words, place a straight edge close to the point *T*, and also touching the arc *f* in one point. Then along the straight edge draw the line *T G*, which will be the tangent required.

Directions.—In the upper part of the space marked 16 draw a circle, and on its circumference choose any point; through this point draw the tangent, as explained in Art. 144. In the lower part of the same space draw an arc of a circle similar to that shown in Fig. 110; then through any chosen point in this arc draw a tangent, as explained in Arts. 145 and 146.

The line *T E* has been drawn through the center *T* of the arc *B T C*, perpendicular to the chord *B C*, and will bisect the chord. Therefore, if the line *T E* is produced, it will pass through the center from which the arc *B C* was drawn. But the point *T* is also the point of tangency, and a line drawn through this point to the center from which the arch *B C* was drawn will be perpendicular to the tangent; therefore the tangent *T G* and the chord *B C* are perpendicular to the same line, and consequently must be parallel. Hence our construction in Fig. 110 is correct.

Draftsman's Method.—When a tangent is to be drawn as shown in Fig. 109, the draftsman will first draw a radial line from the center of the circle to the point of tangency, and then, with the aid of the T square and set square, as explained in Art. 107, will draw the tangent perpendicular to the radial line.

Problem 16.

147. THROUGH A GIVEN POINT OUTSIDE OF A GIVEN CIRCLE TO DRAW A TANGENT TO THAT CIRCLE.

Fig. 111. Let *A* be the given point and *B D F* the given circle, it is required to draw through *A* a line tangent to the circle *B D F*. Join the center *C* of the given circle and the given point *A* by a straight line *A C*. Bisect the line *A C* at *E*. (See Art. 110). From the point *E* as a center and with a radius equal to *C E*, describe a circle cutting the given circle in the points *B* and *D*; through the points *B* and *A* draw a straight line *B A*, this line will be the tangent required. Again we can draw a line through the points *D* and *A*; this line *D A* will also be a tangent to the same circle, and the point *D* will be the point of tangency. Hence, when the given point is outside of the given circle two tangents can be drawn through the given point *A*. The line *B C* is perpendicular to the line *B A*, because these lines are chords drawn from one point *B* in the same circumference *C B A*, see Art. 108, and therefore the line *B A* will be tangent to the circle *B D F*, and the point *B* will be the point of tangency.

148. Instead of the foregoing we may employ the following method and obtain results equally correct.

Fig. 112. Let *B* be the given point and *A F G* the given circle, it is required to draw through the point *B* a straight line which shall be tangent to the given circle *A F G*.

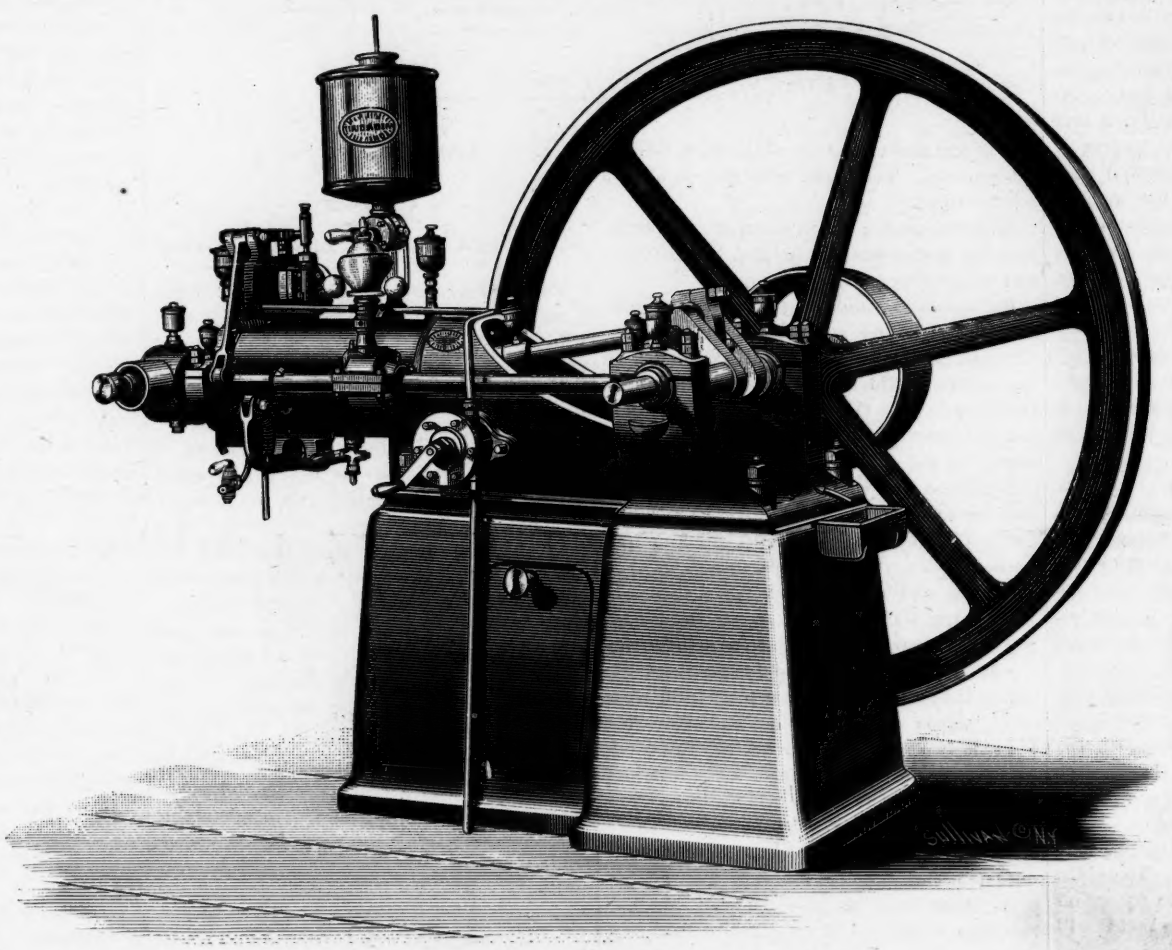
From the point *B* as a center and with a radius equal to *B C*, draw the arc *D C E* of any length. From the center *C* and with a radius equal to the diameter of the circle *A F G* draw a short arc intersecting the arc *D C E* in the point *D*; through the point *D* and the center *C* draw a straight line cutting the circumference *A F G* in the point *F*; through the points *F* and *B* draw the straight line *F B*; this line will be the tangent required, and the point *F* will be the point of tangency. Should it be required to draw a tangent through *B* which shall lie on the other side of the line *C B*, then from the center *C*, and with a radius equal to the diameter of the circle *A F G*, draw a short arc intersecting the arc *D C E* in the point *E*; through *C* and *E* draw a straight line intersecting the circumference *A F G* in the point *G*; through the point *G* and *B* draw the tangent *G B*.

The line *C D* is a chord in the arc *D C E*, which has been drawn from the center *B*. By construction the length of the chord *C D* is equal to the diameter of the circle *A F G*, and since *C F* is a radius of the same circle it follows that the *F* must be the center of the chord *C D*. But according to Article 125 a line drawn through the center of a circle and the center of the chord subtended by part of the circumference of the same circle will be perpendicular to the chord; therefore, the line *F B* will be perpendicular to the line or radius *C F*, and will be tangent to the circle *A F G*.

Directions.—In the upper part of the space marked Problem 17 draw any circle as *F B D* in Fig. 111; outside of this circle choose any point *A*, then through the point *A* draw a line tangent to the circle *F B D*, according to the instructions given in Art. 147. In the lower part of the same space draw a circle *A F G* and then through any chosen point *B* outside of the circle *A F G* (as shown in Fig. 112) draw a tangent to the circle as explained in this article.

Draftsman's Method.—In drawing a tangent as shown in Fig. 111 or Fig. 112, the draftsman simply places the *T* or set square so that the edge of the same will just touch the circumference of the circle in one point, and also touch the given point, then along the edge the tangent is drawn.

If the draftsman wishes to find the exact location of the point of tangency he uses the *T* and set square as shown, Fig. 71. In doing so he will place the T and set squares so that the edge *e f* (Fig. 71) of the set square will coincide with the tangent, then move the set square along the edge of the *T* square as explained in Art. 107; and when the edge *d e* of the set square comes in contact with the centre of the circle a line is drawn along the edge *d e*; the point in which this line cuts the circumference of the circle is the point of tangency.



SPIEL'S PETROLEUM ENGINE.

Spiel's Petroleum Engine.

We present with this an illustration of Spiel's petroleum gas engine, which F. St. George How, agent for the patent holders, is now introducing in this country.

In general appearance, the petroleum engine does not differ greatly from some horizontal types of gas engines, except that it carries a small reservoir above it for oil.

The operation of the engine may be briefly explained as follows: The petroleum is drawn from a tank to the reservoir on the engine by means of a small centrifugal pump fitted to the engine. When the number of hours in which the engine has to run can be previously ascertained, the size of the reservoir can be so arranged as to supply petroleum during the whole time without any further attention. In this case the reservoir is filled before starting. Vaporization of the petroleum previous to use does not take place, the engine using it in its fluid condition. From the reservoir the petroleum is conducted by a pipe to a pump, by which small measured quantities are injected into the cylinder of the engine, and at a given point it is ignited by means of a small spirit lamp. The piston, on its out-stroke, draws in a charge of air and petroleum, and on the return stroke it compresses this mixture, which is exploded as the crank passes the back center. The combustion and expansion of the charge take place at the third stroke, the products of combustion being driven out at the fourth stroke. There is thus one acting stroke in every four, motion being continued during the other three by means of a fly-wheel. In order to keep the cylinder cool, it is water-jacketed. The engine is set in motion in a few seconds, simply by lighting the lamp and turning the fly-wheel.

It is claimed that this engine possesses all the numerous advantages of the well known gas engines, and the one additional, that it is in no way dependent on a local supply of gas. It can, therefore be erected and used in any locality wherever it is possible to transport oil. It is also claimed that since the governor controls the speed, and when the engine is not overloaded it will work with great steadiness and regularity, and on account of its cleanliness—a furnace and chimney not being required—these engines are well adapted for printing establishments, and specially suitable for driving dynamos for electric lighting in country houses. The consumption of petroleum is automatically controlled, and we are informed that for 6 cents per hour 4 to 4½ horse-power can be obtained. The Spiel Petroleum Engine can be seen in operation at 12 Cortlandt street, New York.

A simple means for testing the value of different kinds of coal would fill the proverbial "long felt want." It should be something that any man of ordinary intelligence can use and understand, and from which he can obtain results accurate enough for practical purposes.

Personal.

W. H. Francis, for several years representing Wm. Sellers & Co., and the Edge Moor Iron Co., at 79 Liberty st., New York, severed his connnection with those establishments last May, and has purchased an interest in the Kensington Engine Works, limited, located at Beach and Vienna streets, Philadelphia. That company have a license as sole manufacturers in the East of the well-known Buckeye Automatic Engine. Their shops are well equipped with good tools, and have first-rate facilities to produce good work. Among their specialties are feed water heaters, filters, super-heaters, boilers and other articles belonging to the fitting up of complete steam power plants. The company also make a business of contracting for general machinery and mill work. Mr. Francis is a gentleman of ability and integrity, and has a large circle of friends in the mechanical line. He is secretary of the company, and his brother, H. C. Francis, is manager. Both are pushing men, and we expect to see the establishment prosper and expand.

British Exports of Metal Goods.

British exports during November, 1885, and November, 1886, as compiled by their Board of Trade, show some interesting results. The totals on almost all metal goods are larger this year than last year. Germany remains the best customer for British machinery, but the amount purchased decreased from £92,858 to £88,633. If steam engines and machinery are taken together British India is the best buyer, the amount being £101,809 against £107,717 in November, 1885. Australia buys the next largest amount, Russia next and France next. Then comes the United States with purchases of British steam engines and machinery increasing from £28,059 to £49,109. At the same time our purchases of pig iron increased from 10,804 tons to 18,909 tons, steel rails from 35 tons to 20,039 tons, and unwrought steel from 2,154 tons to 14,666 tons.

Machine Tools for Patternmakers.

BY F. W. BARROWS.

In preparing work for the lathe it is necessary to provide some way of holding split patterns firmly together. Small patterns may be held together by gluing a short space at each end, beyond the length of finished piece, but if fastened in this way the turning must all be done before separating the pattern. A better way is to put a screw in each end, then you may take it apart as many times as you wish. This is sometimes desirable; as, for instance, in turning a piece any portion of which is required to be as nearly a perfect sphere as possible. After the pattern has been centered accurately in the joint turn down a place opposite the center of ball to the size required, and make a line to locate center of ball, then take the pattern apart and draw the center line across one-half, then strike a circle the diameter of required ball, having its center located on line already made, and with your knife or a chisel cut off one side of pattern to the line of circle, taking care to cut off the right side. This will be on the side of joint towards you, at the top, as the pattern revolves in the lathe, or hold the half pattern with the live center end towards you and the joint up, and cut off the right hand side. Replace the pattern in the lathe and turn down just to this line and you will have, practically, a true sphere. Any split pattern, the outline of whose surface is composed of curved lines which are hard to locate from the outside, may be laid out in this way and turned up more accurately than is possible in any other way. The lathe should be stopped as often as is necessary to note where you must cut away the pattern. If your lathe has iron cones on counter and spindle you won't get along as fast as you could if they were properly provided with wooden cones, as it takes longer to stop and start the heavy iron ones.

Large split patterns may be held together by dogs driven in each end, at one or both sides of the centers, or hardwood centers may be used, like Fig. 77. Iron plates are sometimes used similar to 77, but these are hard on the lathe centers, especially the tail center, when it isn't in line with the spindle, although they may used at the spindle end in connection with some form of lathe-dog for driving the work. In all cases a wooden center piece at tail end, with a center like Fig. 76, will always wear well and run true. I have seen an ordinary face-plate put on head end of pattern and then screwed on the spindle. At the same time an iron plate was put on the opposite end of pattern for tail center. This is a poor way. How are you going to square off the end of pattern for face-plate so that it will run exactly true; that is, supposing the tail center to be in line with spindle. If it isn't in line, it won't make any difference whether the end is square with spindle or not—it is bound to strain the lathe. After the face-plate is fastened on the work, and then screwed on the spindle, it forms a rigid joint between spindle and work, and they will revolve as one piece, or more correctly, will strive so to do. The axis of revolution* will be a straight line, drawn from the center of spindle to the tail center; and if the tail center isn't in line, this axial line won't pass through the center of front journal box, so your lathe will probably run hot. This is illustrated by Fig. 78, where the tail center is below line of spindle. Heavy split-patterns should not be run at too high a speed, as the centrifugal force generated will spring open the joint, and as a result, the pattern, when finished, will not be round.

Care should be taken in centering split-patterns for the lathe. Get the center exactly in the joint, especially if the pattern is to be made of more than one piece; and if it is only one piece, and has any part of it squared up, how can you square it accurately, if the pattern isn't parted at the center? If the pattern is made up of two or more pieces, and you get these pieces all centered out of the joint, how can you tell when the centers are all located in the correct plane? and if the casting is to be hollow, how will you make the core box so as to leave the casting of the right thickness throughout?

There is a way of getting round all these difficulties. You may fit your pattern together, making offsets in the parting, to keep the centers of all the different pieces in the same plane. These offsets give the pattern a kind of rustic look, and perhaps the moulder will have to borrow a stepladder to get up and down over these offsets, in making his parting. They will also help to make a poor casting.

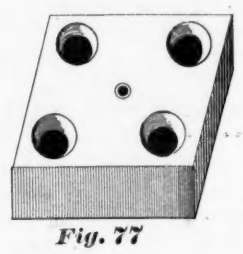


Fig. 77

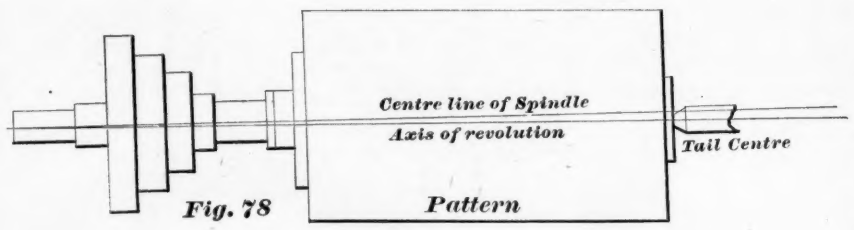


Fig. 78

Another, and a much easier way, is to locate the center exactly in the joint of each and every piece.

Face-plates should be put on with a well-fitted thread, and a good liberal shoulder. You will find it very easy to get one fast on the spindle, if the thread is a loose fit and the shoulder small. On the contrary, when they are properly fitted, it will be a pretty hard matter to get one fast; but as we are all liable to meet with accidents when turning, we may be so unfortunate as to get one stuck fast. To prevent this I have found a paper washer, well soaked in oil and placed between face-plate and shoulder on spindle, to be a good thing. If you have never tried this, you will be surprised to see what a difference it will make. To keep the dirt from collecting on the thread inside face plate hub, file a notch across the thread on spindle; just where it becomes a full thread, cut the notch to the full depth of thread. Then, if you keep the notch clean, it will, in turn, clean out thread inside face-plate. This won't work very well if the thread is a loose fit.

Some lathes intended for very heavy face-plate work have no thread cut on spindle, but instead, the end of spindle is turned to a slight taper, and the face-plate bored to fit, and is drawn up to the shoulder on spindle by a taper key passing through the hub of face-plate and through spindle. A face-plate fitted in this way don't get stuck on the spindle.

A small face-plate fitted to go into the taper hole in either live spindle or tail spindle is sometimes very useful.

A great many tools may be made for the lathe which are useful either in saving time, or by bettering the quality of work turned out, but as these are to a great extent what may be called special tools, I shall not mention many of them. There are some that are useful to all, among these are a chuck for drills and another for bits with square ends; both these chucks should be fitted to either spindle. Then a pair of female centers are very handy on small work. Make the live one on a very slight taper, that it may center and hold any round piece that will go into the center.

In fitting centers, chucks and all other tools for a speed lathe, you should always keep them as close to the housing as possible. In other words, make them as short as you can, and as light as is consistent with strength. Weight in any part of a speed lathe which revolves with the spindle is something to be avoided, especially where it is in such shape as to overhang the bearing; for while it doesn't matter much about the weight if it is perfectly balanced, it is hard on the front bearing of spindle, where it overhangs much. Then, if it is a tool to drive some piece of work, the nearer the work is to the journal the better it is for both work and lathe. Again, if it, the tool, isn't balanced and is also made to project away out toward the other end of lathe, you will have hard work to keep the lathe from running hot or to turn up a piece of work round and true.

In my next paper I will describe a chuck which is very useful on some kinds of small work, and which will space off and center holes to be drilled or bored anywhere within the limits of the tool. I will also describe a peculiar job of turning.

*By this I mean the axis about which the pattern and spindle, now held rigidly together by face-plate, would strive to revolve.

New boilers for the Consett Iron Works, England, are to be built so they can be fired with gas instead of coal, if found advisable to do so.

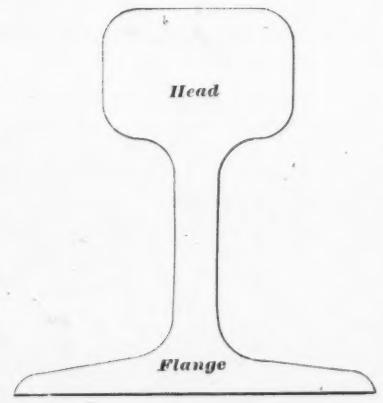
Some Notes on Steel.

BY JOHN COFFIN.

ONE OF THE UNEXPECTED THINGS EXPLAINED.

Prof. Sweet said in his paper on "The Unexpected Which Often Happens": "One who would predict how a steel rail would behave in cooling would find himself twice wrong." I am not certain that I quote him literally. Before I undertake to explain I will first state the facts for the benefit of those whose attention has never been called to the subject. As a rail leaves the rolls the head being thicker than the flange (see sketch) retains more heat, so that if the rail is straight at this time when it becomes cold the head will be concave. To avoid this and leave it straight when cold it is cambered while hot, thus making the head convex, so that when it cools it will be straight. It was the peculiar action of the rail when cooling that Prof. Sweet referred to.

It is as follows: When the rail is pushed on the hot bed the head is convex, but as the cooling progresses the rail becomes straight, and then the head becomes concave, then straight again, then convex, and finally straight.



The explanation commonly given is that the hot head of the next rail being pushed against the flange of the cooling rail causes the flange to cool more slowly, or actually reheats it so that it is hotter than the head, thus causing the rail to be for a short time concave on its head side.

This cannot be true, for the rails go through the same action if pushed on the bed flange first; and it is absurd to think that the head of the first rail can heat the flange of the second rail hotter than its head, for the head of the first rail itself is necessarily cooler than the head of the second rail, for it was rolled first, and has had more time to cool. And besides, the last rail on the bed, when they are pushed up heads first, goes through the same action, and there is no hot head against it. Furthermore, if a rail be pushed out by itself and allowed to cool, it behaves exactly the same.

We must look elsewhere for the reason of the head becoming concave for a time while the rail is cooling.

I think we can look for the cause in the re-heating due to the chemical change of carbon, as explained by an eminent Swedish engineer. I will digress to give his theory.

In cooling, the carbon changes, hardening carbon to cement carbon, and in this change there is a certain amount of chemical energy destroyed, which results in giving out heat. He illustrates by a beautiful and simple experiment, which I will cite:

A piece of high carbon steel is heated to an orange color on one end, and then taken in the dark, and the cooling observed. It is evident, as all grades of heat, from a black to an orange, are represented, that some part of the bar is at a temperature at which its carbon is almost ready to change. This is made manifest by a bright streak, or band, appearing between the highly heated end and the black part. This band appears hotter than the metal adjoining it on both sides; yet it is certain that a moment before this part was cooler than the metal on one side of it. So the only conclusion we can draw is that this metal has re-heated itself. Furthermore, the corners, which first began to cool, again get bright, and at one time in the cooling operation are hotter than the center of the bar.

This is a simple experiment anyone can try. A bar of ordinary tool steel, $\frac{1}{4}''$ thick and $1''$ wide, being a very good size, though any size will do.

The question naturally arises, although it appears to get hotter, does it actually do so, and does it expand at the same time?

To determine this I took a bar of steel 9 per cent. carbon, 4 feet long, and heated it uniformly to an orange color. I then took it out of the furnace and by a previously arranged device clamped one end and measured the contraction at the other end, having previously made a center punch mark near the end for one point of an ordinary pair of dividers, and prepared a surface on a fixed plate to scratch on with the other point. I found the contraction was as follows: It first contracted $\frac{1}{8}''$ when expanded $\frac{1}{32}'$, then contracted until cold, $\frac{9}{16}''$, making a total contraction of $\frac{21}{32}''$. It was not quite cold yet; I could bear my hand on it when I took the last observation. I repeated the experiment a number of times with the same result.

I then tried a bar of 17 per cent. carbon, and there was no re expansion that I could notice.

But its behavior seemed to be as follows: It contracted $\frac{1}{64}''$ during each 5 seconds for three-quarters of a minute, and then did not seem to change for 20 seconds, when it commenced contracting again. If my means of measuring had been finer I might have detected a slight re-expansion. It was a $\frac{5}{8}''$ square bar that I experimented upon.

I then took a bar of 7 per cent. carbon and it contracted continually until cold, though not quite regularly. I think now that we have established the remarkable fact that steel expands at a certain time in its passage from a hot to a cold state. We can return to the rail problem again and offer this explanation:

While the rail is cooling the flange reaches the re-expanding stage before the head does, and makes the head concave; later on, at about the time the flange begins to contract again, the head reaches its re-expanding stage and the head becomes convex again, and more convex than it was when it left the cambering machine. It has always seemed to me that our colleges are the places to try such experiments as these. Where they do not lead to direct practical results the manufacturer does not feel like spending money to try elaborate experiments, and to have their full measure of instructiveness they must be elaborate and accurate.

Notwithstanding what has been said of business depression in England it appears that the export of rails was somewhat greater in 1866 than in 1865. It is also noticeable that there is a recent large increase in the export of rails.

Locomotive Pumps.

BY WM. Y. SCHMUCKER.

The pump is one of the most useful engines known to man, yet few bench mechanics can truthfully say that they thoroughly understand its working principle, simple though it is.

The world is surrounded with an ocean of air. The pressure of this air at the surface of the earth is about fifteen pounds per square inch, and the higher above the surface we go the less is the pressure. Air at the level of the sea will sustain a column of water about 33¾ feet high (the air having been exhausted from the top of the pipe). A vacuum is a quantity of empty space; that is, space devoid of atmosphere or any kind of matter.

The theory of the pump is based upon the fact that the air has weight.

Ordinary pumps are commonly divided into two classes, namely, lifting and force pumps.

Fig. 1 represents the pump in its simplest form. It is a suction pump and embodies in itself the essential principles on which depends the successful working of all common pumps. It consists of a cylinder or barrel, a piston, feed and discharge pipes and two valves. Appropriate operative mechanism is connected to the piston rod. One of the valves is located at the piston and the other at the top of the suction or receiving pipe. Both open upward. Let us assume the piston to be at the top of the cylinder as shown, the air being uniform th oughout the barrel and pipes. When the plunger is moved downward it compresses the air in the space *A*. Now there is a constant weight of about 15 pounds per square inch (that of the atmosphere) upon the top of the valve *E*; but as we lower the piston the compressed air in *A* will acquire a greater pressure than that above the valve *E*. It will consequently open the valve. But when *E* lifts, the compressed air below the piston will rush through the opening thus made and leave but little between the bottom of the cylinder and the piston. On raising the plunger the air in *A* will expand and fill out its space, and in so doing will become rarified and produce a relative vacuum. Consequently we have the 15 pound pressure on the top of *E* firmly holding it to its seat; none in *A* (comparatively speaking) and 15 pounds per square inch in *D*. Valve *F* has therefore no pressure on its top, and 15 pounds on its lower side. When it lifts, the air in *D* passes into *A*, filling more space than it had when in *D* at normal pressure. Increase in the volume of a gas is followed by decrease in its pressure. The water which rises in *D* has the atmospheric pressure upon its surface *G* outside, and a greatly decreased pressure on its inside surface *D*. It will consequently be forced up the receiving pipe to a distance depending upon the number of strokes which have been made. When it fills *A* and the piston is lowered it will pass through *E*, be lifted by the piston on the upstroke and discharged through *C*. While the piston is rising the chamber *A* becomes refilled with water.

As before stated, the atmospheric pressure will sustain a column of water about 33¾ feet high (at sea level), and therefore water cannot be raised to a greater height with a pure suction pump. In practice, owing to friction, leakage and a few other considerations, a height of twenty-eight feet is seldom exceeded. By placing another valve in the delivery pipe like the dotted lines in Fig. 1, the height to which it will raise water is alm st unlimited, and corresponds to the power applied. This last arrangement is often called the lift pump.

The force pump (with air chamber) as applied to locomotives, is shown at Fig. 2. The cavity *M* is filled with water by suction on the outward stroke, which is then forced through the holes in the top valve on the return stroke into the air chamber and feed pipe. After water is drawn through either valve, the latter falls to its seat and prevents any return of water to barrel or tank-hose. The lifting pump has a valve in the piston and lifts the water bodily, whereas the force pump presses the liquid through the valve and has a solid plunger. When the water enters the top chamber the air therein will be compressed, and will form an elastic cushion for the water to strike, thus avoiding sharp shocks which would otherwise follow. It will then pass through the pipe and check into the boiler.

The design of locomotive pumps varies with their location. Those driven from a lug cast on the cross-head need no guide for the plunger, and are placed close to the frame. Some are coupled to an extra eccentric on one of the axles.

Two pet cocks are usually provided; one near the base of the air chamber and used mainly to ascertain whether the pump is working properly, the other in the barrel, the purpose of which is to let out water remaining in the pump after a run to prevent freezing. The small orifice in the receiving elbow, Fig. 2, takes steam from the boiler to heat the entering water. The valves are properly guided when lifting by ribs cast in their cages.

Pumps to be repaired must first be taken apart, and the work thoroughly cleaned, and correctly marked. In those like the one illustrated we will frequently have much difficulty in removing the cages from the barrel. The impurities of the water will collect around the cage, and the iron of the barrel will rust and corrode in such a way as to make an almost perfect union between the

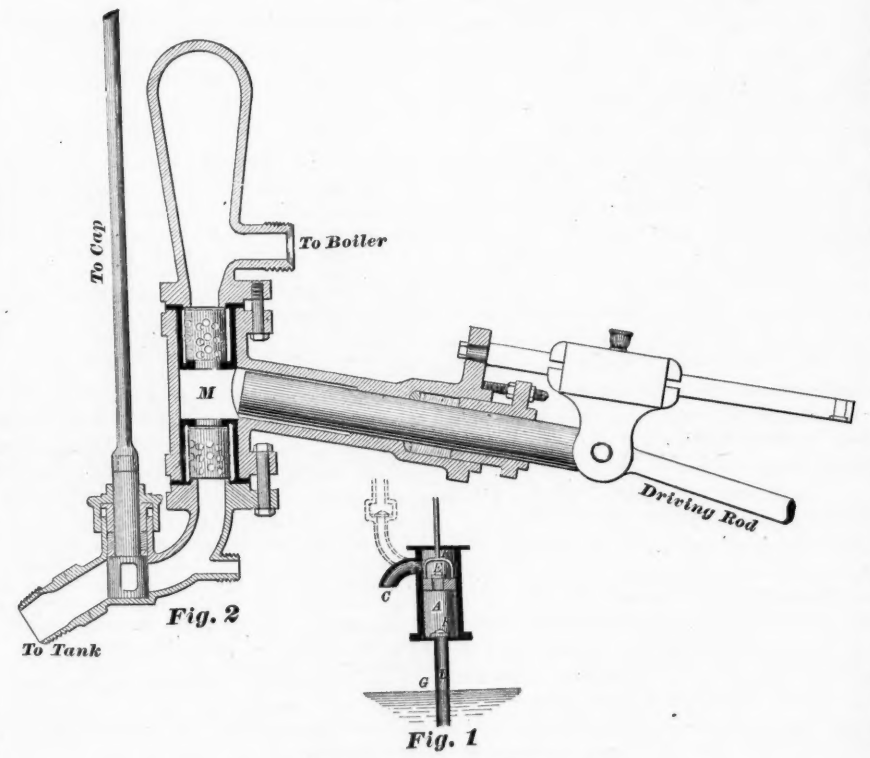


Fig. 2. Fig. 1.

LIFTING AND FORCE PUMPS.

brass and iron. If neither cage can be easily started, thrust a bar through one of the openings down against the opposite cage, and force it out with the bar alone, or by the aid of a maul. One having been removed, procure a piece of round iron, of nearly the same diameter as the opening, and place it against the cage, inside the barrel. It can then be dislodged by using a sledge and a set or punch. In an extremity they must be pressed out on a screw or hydraulic jack. Any resultant battering of the cages on the inside or outside joints can be rectified by returning. If not too much under full size, the guide may be replaned, and the plunger trued. After turning off the plunger, place a long straight-edge inside the crosshead, and parallel to the centerline of plunger. Caliper between straight-edge and plunger; if it does not caliper correctly, the crosshead needs re-slotting. If advisable, the case-hardened pump rod pin may be annealed and trued, and the rod re-bushed and repaired. A new gland and packing ring are invariably necessary, if the pump has run any time.

On roads where there are only one or two standard varieties of pumps in use, it is good policy to save all old glands and rings as they can often be re-bored to suit larger plungers than those to which they first were fitted. The joints are to be replaced and ground, emery being employed when brass and cast-iron grind together, small joints, brass to brass, being best ground with glass. Plug up any honeycombings, or corroded spots in the joints, with annealed copper. Cages and valves must be turned or filed off, if badly hammered. Be sure to make the lift right. It is regulated by substituting proper-sized valves for those with which the lift is incorrect, or by turning down the valve or cage to proper size. The receiver should in every case have less lift than the discharge. On locomotive pumps like the one illustrated, the top valve can have about $\frac{4}{16}$ of an inch, and the bottom or receiver $\frac{1}{8}''$ (3″ plunger). The check is given more than the discharge valve, generally from $\frac{1}{4}$ to $\frac{3}{8}$ of an inch. Practice varies somewhat as regards lift of pump valves and check valves; but the above are good proportions to observe. The general rule should be, small lift and large valve area, thereby avoiding the excessive hammering consequent upon a long valve stroke. Care should be taken to grind the valve faces to their proper seats. A handy contrivance for holding cages and valves for grinding was illustrated in No. 10, Vol. IX of the AMERICAN MACHINIST.

The water-cock in the receiving elbow (bottom casting of pump) should have the packing removed and be examined. Unless broken or badly abraded, it may be at once replaced as no repairs are needed.

Ths outside of the cross-head where the gibs bear will be found to be worn. They must be chipped out and have pieces of wrought iron dovetailed and sprung into the recess. Pene it tight and file off flush inside, making the outside to suit the gibs which should bind snugly on the crosshead ends. Draw file and polish the replaned or new guide. Fit the gibs on the guide. Hold the cross-head horizontally in the vise with the oil-hole up, put the gibs in place (to do this it may be necessary to file off the top of one end of the upper gib) and try the guide in the cross-head. Whatever space shows between gib and guide must be filled out with liners. Line up so that it will require very nearly all your strength to move the guide its entire length through the crosshead in which it may be allowed to remain for the present. Place the barrel of the pump on the bench top side up and fasten it at right angles with the bench's length in such a way as to allow the gland studs to project over the edge their full length. It is to be firmly held by means of two bolts passing through the holes of the lower flange and the bench. Now try the slip ring in the barrel; also the gland. If they are tight correct them. Try them also on the plunger. Then slide gland and ring on the plunger, lift guide and crosshead bodily and insert them in the barrel. Screw the nut on guide back of the flange. Pull the plunger outward to its extreme point; then try to enter the slip ring into the barrel; if incorrect sidewise throw the guide with a soft hammer, or in some styles of pumps with liners. If not right top and bottom, change the liners in the crosshead to suit. Try it likewise with the crosshead near the studs. Make the plunger work in and out easily with gland and ring inside the barrel. Then fit the gland over the studs by straightening them or chipping out the gland. Before putting in the gibs for the last time polish the projecting ends. Run your jambnuts on the studs and fasten the gland in position. Draw up the nut or bolts on the guide.

Our guide having been hung we next remove the barrel, with plunger and guide, to the floor, upside down. Set the bottom cage and valve in the barrel; the water on entering must strike the closed ends of the valves. Having the cage in position put the receiving elbow on the barrel, and bolt it fast. If the old petcock be used, repair it and screw it in. If new cocks are called for, retap the holes and fit them to the tap. Insert top cage and valve and bolt the airchamber to the barrel. Screw in the pet cock, likewise the oil cup on cross head.

LETTERS FROM PRACTICAL MEN.

Disadvantages of Steel Crank Pins, Steel Piston Rods and Extension Fire Boxes.

Editor American Machinist:

There seems to be some truth in the old adage that there is nothing new under the sun. In the retrograde movement now going on in some parts of locomotives I remember well the time when our crank pins were made out of good hammered iron, and, when turned to size, were case-hardened to the required depth by a longer or shorter time kept in the furnace. I always put a piece or two of scrap iron in the box, with the crank pins, so, on breaking the pieces of scrap, I could see the depth the hardening had gone in. But steel came to be considered the best, and almost became universal; and with them came cut pins and hot brasses, and, worse yet, broken pins, without a sign of warning, and up goes the foot board, and out goes cylinder head, etc. But I see my brother mechanical machinists are coming back to first principles. Well, it is better late than never. Steel piston-rods have been equally treacherous. They often break square off, not in the weakest part, either. I prefer a good hammered iron rod, and heat it the full length, and twist it from end to end, so the grain runs spiral, and put a good rounding on all corners, with the keyhole half round at each end. Then I can feel safe. All piston-rods, valve stems and pump plungers should be twisted, to prevent the packing from fluting or scoring them. I think that the time will come when, not only steel crank pins, but steel fire-boxes will be among the things of the past. It has become a mooted question, whether the extension smoke-box has not almost run its length; while it is as good as the old bell slack for catching sparks, it causes a far greater consumption in coal, and is far more uncertain in its steaming qualities, especially where a standard diaphragm, netting, exhaust pipe, etc., have been adopted for every engine, reminding me of a mechanical machinist who adopted a 17″ slack for all his engines, with cylinders from 15 to 18″ diameter. I remember a passenger engine once that steamed very badly, and a change was suggested in the smoke box, but not allowed on account of its being standard. But the foreman had the two lower plates on the diaphragm taken out secretly just to try if it would help the steaming quantities. The engine went on its regular run, and on its return the engineer reported sixty bushels of coal saved and plenty of steam. After a few trips, the plates were put in again, and the result was, more coal used, and no steam.

Mr. F. T. Hampton read a very excellent paper on fuel energy and economical generations of steam power. Speaking of fuel used in locomotives he says that only about 2½ per cent. of the fuel thrown into the fire-box is converted into useful work. What becomes of the other 97½ per cent.? If we make a test of the heated gases passing out of the smoke box we find the temperature ranging from 600

to 850 degrees. Many have been the devices tried to overcome this great waste. Return flues, Duppell boilers, feed water heaters, extension smoke boxes, single nozzles, etc. have been used, and yet the waste goes on. I have often thought the air pump exhaust caused considerable waste of fuel, acting like a blower all the time. The vacuum brake has a great advantage in this respect. The large fire-box, and consequently large nozzle, reduces back pressure, and keeping the coal in the fire-box where it belongs, will have a good deal to do in reducing the fuel bill, and keeping the engine clean without extension smoke box and its attendant evils.

J. W. Bingley.

Turning Pulleys—Lathe Face Plates.

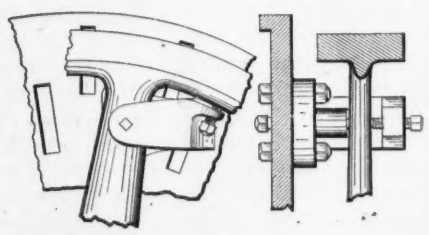
Editor American Machinist:

Some unfortunate experience in recent attempts to get pulleys that run true leads me to call attention to a method I believe to be the correct one, producing pulleys meeting the general demand that they shall be cheap and good. I mean where a common turning lathe is used for boring and turning. And here it may be pertinent to remark that the pulleys we have had reason to complain about have been made at places where shafting and pulleys are a specialty, and presumably finished by special pulley machinery.

I will also take this opportunity to remark that I was told by a man who makes a business of the small pulley trade that they, on common lathes, could beat, in quantity and quality, any special pulley machinery he had ever seen, and that he had seen all he had ever heard of. From his statement of the number turned out in a day, I should judge they could.

But to the point. Pulleys that wobble from $\frac{1}{8}''$ to $\frac{1}{4}''$, when set upon a ground mandrel and run on dead centers, are not good enough, and the system upon which they are made, that renders it possible to make them so, must be wrong.

The plan that seems to me to be right is this: First, all pulleys to have six, or if very large, nine, or if small, three arms; second, to have bolted to the face plate three brackets, projecting out far enough to bring the rim of the pulley 1″ or more from the face plate, and of such shape at their outer ends as will grasp an arm of the pulley, with set screws to adjust the pulley sideways, and to hold it firm, and set screws to set pulley



concentric. [The small engraving will represent Prof. Sweet's idea; as shown, it is applied to turning a balance wheel.]

With this system of holding, it is not possible for the lathe man to spring the pulley in any way; and—what is of far more consequence—if the casting has any inherent strain, it will take care of itself when the roughing cut is taken off, and no letting up on the straps, after the roughing cut is over, is necessary or possible. Third, everything that is to be done to the pulley, both in the way of boring and turning, can be done at one setting, and if the brackets are set out near the rim, the driving power is the strongest possible; boring the hole too large or tapering is about the only way to make a poor job.

In setting pulleys, hand wheels, and, in fact all concentric work that is to be turned outside, and not inside, the "truing up" should be done by the inside instead of by the outside, as is the almost universal practice, for the reason that then, when finished, the rim will be of practically uniform thickness. Another point—if there is any question about a piece holding up to size, if when set by the inside it will not then hold up to size, no amount of shifting will help it.

With a face plate having three radial slots, the brackets can be set out and in to hold different size pulleys, and this brings up the question of face plate slots, upon which lathe builders may well spend a moment's thought. We have one with fifty-three slots in the outer circle, and it would be a great consolation to us if the maker could be compelled to use it. It never comes right for anything

What there should always be is twelve, or a multiple of twelve, in the larger sizes. This number is always divisible by both three and four, and when practicable, three should always be used, unless the piece to be treated is so strong as to be beyond the possibility of springing, or so weak that three points will not sufficiently support it; and then, in the first case, four are better, because a piece can usually be more quickly set on four points than any other number, and in the latter case enough points of supports must be used to hold the piece against the cut.

John E. Sweet.

Squaring Up Rough Bolts.

Editor American Machinist:

One day two hundred $1\frac{1}{4}''$ rough bolts came into the shop with the under side of the heads so uneven that it was necessary that they should be faced off in some way. To center them all and do the work in a lathe with a side tool seemed like an interminable job. Lee, who was a sort of leading mechanic in the shop, suggested that the work be done with the drill press, and was told that he was crazy on the subject of doing all kinds of machine work with a drill press. But finally he was given the job and allowed to select his own method.

He took a piece of $1\frac{1}{4}''$ steam pipe slightly longer than the bolts, and into one end welded a piece of round iron and turned it to fit the socket of the drill press spindle. The other end he turned off just enough stock to make it round for about three inches. Upon this he shrunk a common set-collar bored to fit. In the end face of this he cut three radial grooves $\frac{3}{4}''$ deep and $\frac{1}{4}''$ wide into which he fitted pieces of steel. These trued up, backed off and fastened with set-screws at the side, made a hollow milling tool of good quality at a small cost.

The tool was put into the spindle, a bolt slipped in and the table swung under. In a convenient place the big monkey wrench was clamped down to hold the bolt from turning and the drill press started. The cutter was fed down until the head was faced, then it was raised about $\frac{1}{4}''$ and the table swung away and the bolt dropped to the floor. Another was picked up, slipped up the pipe, and the table brought into position, and the operation repeated until the bolts were finished without stopping the machine.

Of course the facing was not perfectly "square" with the axis of the bolt, nor is the axis of a rough bolt always a straight line; but the job was good enough, and "good enough" with a true mechanic means just right.

F. S. Johnson.

Waukesha, Wis.

Experience With Blue Prints.

Editor American Machinist:

If you will allow me a few lines in your valuable paper I will state some of my experience with blue prints, and thereby try to answer some of the questions asked in your publication of December 18.

1. Almost any proportion of chemicals will make blue prints. The one I have been very successful with is $1\frac{1}{4}$ ounce red prussiate potash, 8 ounces soft water (usually rain or aqueduct water) $2\frac{1}{2}$ ounces citrate iron and ammonia, 8 ounces soft water; allow sufficient time to dissolve and mix well.

2. Any white paper that has a hard finish, without being sized or calendered. If the paper has a soft finish it absorbs too much mixture, while only a surface layer of chemicals is required.

3. Spread with a soft sponge first in one direction then at right angles to it. In putting on the first coat, the sponge should be quite wet, and in second coat pretty dry so that any superfluous mixture can be taken up. Have 3 or 4 drawers and begin at the first one laying a sheet in each, and by the time you have prepared 3 or 4 sheets you can place one on the first sheet, and so on.

4. Place the print in a tank or bath pan of zinc or other non-corrosive metal, wash until lines are white, usually 5 to 10 minutes. Use clean water. Seldom more time is required when linen ledger paper is used.

5. Can get fair prints if paper is kept in a dark drawer, turned face downward, a month after it has been prepared, though when paper is fresh it will be a deeper blue for the same exposure.

6. The most transparent paper is the best, but when a drawing is to be handled frequently tracing cloth is preferable.

7. When the print has been exposed long enough it will have a grayish cast and on a clear day 5 to 10 minutes will suffice.

Using coloring or other partly opaque liquid on the drawing will show different shades of blue on the print. By using more or less chemicals to the amount of water given can produce prints differing in color from a sky blue to a deep purple.

Any other questions bearing on the subject, and not answered here, I will try to give my attention should they come to my notice.

A. W. Jacobi.

268 South Sixth St., Newark, N. J.

Western Railway Club.

At the last meeting of this Club the following letter was read by Mr. Smart:

Michigan Central Railroad.

Master Mechanics Office,
Jackson, Mich., Dec. 14th, 1886.

To the Western Railway Club:

I was very much interested in an article in the December number of the *National Car and Locomotive Builder* headed, "Startling Discoveries About the Wear of Locomotive Tires," and also surprised at the results of Mr. Rhodes' investigations. It will perhaps be remembered that, at the close of the meeting of the Western Railway Club of October, I made a few informal remarks regarding the subject at the next meeting, viz.: "Section of tires and wheel centers," at which time I expressed myself to the effect that in my opinion we were in many cases using very heavy driving wheels, having in mind at the time 57 inch wheel centers weighing in round numbers 2,750 pounds, with an addition of 3½ inch tire giving an additional 1,100 pounds making an aggregate of 3,850 pounds to each wheel, and that I thought it desirable that the matter be discussed as to whether we might not be benefited in having less weight in driving wheels, even if we had to use better material in the manufacture of centers.

I have not sufficient data at hand to give me assurance that I am correct in my theory, neither do I claim that I am correct regarding the injurious effect due to heavy wheel centers and thick tires. The extra thickness of tire adds materially to the weight of wheels, and we have in many cases from 30 to 35 per cent. more weight in the wheels than is requisite to give the necessary strength for safety and durability, and yet it is a fact that our steel tires in many cases do not give such great amount of mileage more per $\frac{1}{16}$-inch of wear, than we used to get when we used light wrought-iron wheel centers and light two inch tire. With these considerations it suggested itself to my mind quite forcibly that a part at least of the unusual wear of the tire may safely be attributed to the effect of heavy wheel centers and tires and improper and heavy counterbalancing as well, and the excessive wear of the 4-inch tire as compared with the 3-inch tire may perhaps in part be attributed to the extra weight in the 4-inch tire.

The question which I should very much like to hear discussed, is whether it would not be better to reduce the weight of our wheel centers to the lowest possible limit consistent with durability and safety by using gun metal or even steel, and to transfer the weight from the driving wheels, and, if necessary, use it in increasing the size of the boiler or adding to the frame as may be thought best, where it would be relieved by springs, and thereby do away with the extra dead weight in the drivers, which it would seem produces a greater wear on the tire and is more injurious to the track than the same or even greater weight would be when transferred to the engine where it would be relieved by springs.

In the article referred to in the beginning I notice the writer says: "A significant feature of the newly discovered data regarding the wear of locomotive tires is that they wear with extraordinary rapidity at the part where the power is least likely to cause wear by slipping." Now it seems, and it has always seemed so to me, that the first half inch at least of a 4-inch tire ought to possess nearly as good wearing qualities as the same amount of metal in a 3-inch tire. On account of mechanical defects in rolling, the tire would naturally be less dense, so to speak, as it wears away towards the center, and consequently would wear faster than at the outside. That idea and the objection of the extra weight have kept me from using 4-inch tires, but these later developments would seem to show that there is nothing certain regarding this conclusion. I may perhaps have presented my ideas rather incoherently, certainly somewhat disconnectedly, but if it be the means of promoting investigation in this direction, I shall have reached the result intended.

C. E. Smart.

The following subjects were selected for discussion at the next meeting: 1. Weight of driving wheel and tires; to be introduced by Mr. Smart. 2. Interchange Rules Nos. 12 and 13; to be introduced by Mr. Rhodes.

Secretary Sinclair offered the following:

Resolved, That the Western Railway Club have learned with sorrow of the death of Mr. William Woodcock, President of the Master Mechanics' Association, and of Mr. Leander Garey, long President of the Master Car Builders' Association; and that we extend our sympathy to the families who have suffered this sad bereavement.

The resolution was seconded by Mr. Swanson with particular reference to Mr. Woodcock, and by Mr. Verbryck with reference to Mr. Garey. They referred at length to the many sterling qualities both in public and private life of the deceased. Mr. Rogan also added a word regarding his pleasant business relations with Mr. Garey The resolution was carried unanimously.

Condition and Prospects of the Machinery Business.

LETTERS FROM PROMINENT ESTABLISHMENTS TO THE "AMERICAN MACHINIST."

Warner & Swasey (Machine Tools for Iron and Brass Work), Cleveland, Ohio, write us:

A year ago we wrote you that our prospects for business were quite favorable, but we contemplated no special changes. We have been crowded with work during the entire year, and have increased our working force from forty-five to seventy men, with a proportional increase of facilities. We are about completing an extension to our building that will nearly double our present capacity, and will also contain our offices and draughting room, both of which are supplied with fire proof vaults. We are pleased that there is an increased appreciation of your valuable paper among our workmen, and we enclose a list of thirty-five subscribers for the coming year.

Post & Co. (Railway Supplies, Metals and Machinery), Cincinnati, Ohio, write us:

As you know our business in machinery is largely with railroad companies, and at the present time is quite active, with a very good outlook for the future; in fact, it is almost impossible for us to secure standard machinery now in any reasonable time.

We are receiving and placing orders for future delivery, and we think the demand for machinery for railroads during the year 1887 will continue good.

We have recently had orders from some new branches of manufacture starting in our district, which looks well. We think that the surplus money of the country will go largely into profitable business of this kind during the coming year.

I. P. Richards (Punches and Dies), Providence, R. I., writes us:

Business has been dull with me for the most part of the last year which, I sometimes think, is apt to be the case when we move into a new shop, with increased facilities. We are constantly improving our tools, so as to make goods nearer perfect, and better everyway. The very best punches and dies for a low price, is our motto.

D. Frisbie & Co. (Elevators, Engines, Friction Clutch, Pulleys and Cut-off Couplings), 112 Liberty st., New York, write us:

For the past six months we have been very busy, in fact, most of the time we had all we could do and have run the works over time, and are now doing so. Most of our push has been on our clutch pulley and cut-off couplings; notably for electric-light plants, for which it is peculiarly adapted. Have now two large orders for that purpose. Our new four cylinder engine, for elevators and hoisting, has been improved and perfected, and now is selling and giving good results. We are anticipating all we can do for the immediate future.

Lodge, Davis & Company, (Machine Tools), Cincinnati, Ohio, write us:

We have added a three story building 30x100 feet to our plant for office and warehouse, incorporating what was formally used for offices into our manufacturing plant. As to improvements we submit the following:

We have recently designed a new line of engine lathes, the first of which was finished last September, since which time we have expended $3,000 in special tools to manufacture them, and though up to the present, we have neither published a description, or advertised them in any way, we have orders on our books for the new lathes amounting to $9,000, besides our other business. These orders come from parties seeing them at work in our shops. Our orders for these and other tools at the present time are sufficiently numerous to keep our present force of 120 hands at work for the next three months, and are coming in daily. We have arranged on the new lathes to furnish every lathe complete, including hollow spindle compound rest, rest to turn full swing, adjustable following rest, power cross feed, screw cutting and taper attachment. We also have nearly ready a patented lathe for brass finishing. This tool has a number of very valuable improvements. It is so fixed that the turret head is fed by power to bore and turn taper, and also chase, which operation can be performed as rapidly and easily as on the old style fox lathes. The back gears have patented device to throw them in and out instantly, and while the lathe is in motion. Every lathe is supplied with a substantial slide rest that has solid bearings on bed of lathe, and is also fed by power, while the upper part is detachable the same as an ordinary slide rest. In addition to above a tail stock and screw cutting device is furnished with this lathe, making it suitable for all classes of work. We are paying a considerably higher average for labor than in 1885. We are continually improving the quality of our product and using higher grade material. We find it pays. You will notice that we are highly pleased with your paper as an advertising medium, from the fact that we have doubled our space within the last year, and hope soon to add still more to the amount, if you can spare it. We may also say that in addition to our own line of manufacture we have placed orders with other manufacturers to the amount of $35,000 within the last six months.

Chandler & Taylor (Steam Engines and Machinery), Indianapolis, Ind., write us:

In response to your request we will say that the volume of our business for 1886 has been about double that of 1885. In the spring and summer months we had a very satisfactory trade in machines for making drain tile, and the last four months of the year has brought us more trade in engines than any similar period of our existence. The self-contained engines we are now building have given a new impetus to the engine trade, and while we have not greatly increased our working force, we have introduced a number of new tools specially adapted to our wants, and thereby have increased the output and reduced the cost of manufacture. Profits are nominal, but with the brighter outlook for an increased volume of business we hope, with our present facilities, to show a satisfactory business for the coming year.

The Lane & Bodley Company, (Steam Engines and Machinery), Cincinnati, O., write us:

We have not made any addition to our buildings during the past year, but have made considerable addition to our number of tools, some of which replaced old.

We are closing the end of the year with a larger accumulation of orders and much better prospects for a favorable year's business to come than we have known, at this time, for several years past.

Skilled labor is about 10 per cent. higher than this time last year. Material has likewise advanced, but no increased price has been obtained for our products.

We hope the turn of the year will have convinced all manufacturers that the time has arrived for demanding a legitimate profit upon our work.

Our Corliss engine business inaugurated a little over two years ago is proving very satisfactory, because of the appreciation of our engine by a considerable number of buyers scattered all over the country. There yet remain some buyers who will pay a fair price for good work, and we are confident the number will be increased during the next year.

J. Wyke & Co. (Fine Machinist Tools), East Boston, Mass., write us:

We are glad to say that our business this year has been good; in fact, it has been gradually increasing since about the middle of 1885, at which time we placed on the market our patent universal, screw-cutting, center, depth, angle and twist-drill gauge. This is a new tool, and seems to just fill the "long felt want," if we may judge from the way they are called for, and we are sending them to almost every civilized country in the world. We also lately placed on the market a new combination surface gauge which we are having a large call for. We are now getting ready to place other new tools on the market in the coming year, and altogether we expect to, and the prospects are that we shall, largely increase our business during the year 1887.

Thos. H. Dallett & Co. (Machine Tools, Portable Drills), Philadelphia, Pa., write us:

During the past year we have had a fair business in the portable drills, and an increase of business over former years in hand drills. Have run full time, and as yet have not noted any change in the rate of wages or price of material.

The business we are doing this month encourages us in the hope of still better times for 1887.

J. A. Fay & Co. (Wood Working Machinery), Cincinnati, O., write us:

Our sales for the year 1886 are 20 per cent. larger than for the year previous. We have employed our force full time throughout the greater portion of the year. We have also added to our plant by purchasing a large number of new and improved iron working tools. The unfilled orders on our books at this time are quite large, and the prospect for additional orders seems to be very good.

During the year we have brought out quite a number of very important labor saving tools for cutting wood, which seem to meet the approval of our customers, as we have been favored with a large number of orders for them. One of the most important of these machines is our Doane's Patent Duplex Planing and Matching machine. With this machine we make two pieces of flooring from two different strips, where heretofore one only has been made on the old style flooring machines.

We have advanced labor 11 per cent. There has also been an advance in raw material. Prices of finished machines have not advanced much yet, but there is an improvement in this respect, especially on popular tools where we are behind our orders. We anticipate a good year's business for '87, not only in this country, but in foreign countries, where we have a large trade. The demand for very heavy substantial tools with the latest improvements is increasing, as all users of machines soon learn that tools of this class are the cheapest in the end.

Sebastian May & Co., (Lathes, drill presses and machinists' supplies), Cincinnati, O., write us:

The condition of our business continues to be very satisfactory; with constantly increasing facilities we are enabled to increase the volume, and thus are better enabled to keep pace with the growing demand for our tools. Our orders come from all parts of the world. We have now on our books an order for a complete outfit for India, besides several orders for Australia and South America.

Wages are about the same as last year, but material is slightly increased in cost, and we are getting better prices for our goods than a year ago. We think the prospects for 1887 are very encouraging.

L. Katzenstein & Co., (Metallic Packings and Engineers' Supplies), 357 West street, New York, write us:

The amount of our business in the year 1886 has exceeded our expectations. We have hardly had a day without enough orders coming in to keep us busy and at various times have had to work overtime to fill our orders. The rush of business in the early spring compelled us to transfer our office and factory from 179 Christopher street to our present larger and better located premises at 357 West street.

It gives us satisfaction to state that our exports this year have been unusually large, principally to Scotland. In spite of a lively competition and lower prices abroad, we have successfully competed with foreign manufacturers and have furnished our metallic packing to the prominent shipbuilders on the Clyde for use in the engines of the largest steamers, especially for triple expansion. We consider the prospect for 1887 very fair.

The New York Supply Company (Limited), 50 John street, New York, write us:

Having been doing business under the present name only since March 1, 1886, we cannot report on a full year's business. We have noticed, however, a steady increase in the amount of our sales since we were organized, and they were particularly heavy in September, October and November, and for this month, although December is usually a dull month in our line.

We have secured several first-class agencies from firms of good standing, whose goods are staple articles and of real value; and their sales have, of course, added to the volume of our trade.

We think the prospect for a good year's business in 1887 is excellent, and we expect to see better prices the rule.

We take this opportunity to thank the trade generally, and more especially the dealers in this city, for the great good will they have shown for us; and we trust we shall be able in the future to repay them.

The Pond Engineering Co. (Steam and Hydraulic Machinery), St. Louis, Mo., write us:

The business prospects at this time for 1887 are quite similar to what they were a year ago, for 1886, that is, favorable for a healthy increase in volume as well as prices. With the experience of last spring's strikes before us, we do not feel like making any prediction as to business next year; there are too many "ifs" in it.

On account of this uncertainty, our plan will be to make the most of the situation as circumstances may develop. The volume of our business during the past year shows quite an increase over that of 1885, but prices have been too low. We are in hopes that the increase in business confidence will assist to increase prices.

In some of our specialties, we have been unable to fill the demand, because the manufacturers were behind in their orders, and have therefore lost many sales. We expect, with their increased facilities, that this difficulty will soon be overcome.

The Universal Radial Drill Company, Cincinnati, O., write us:

We are pleased to report a much improved volume of trade during 1886. The close of the year finds us working 13 hours on "back orders," and fair prospects ahead. We have added some tools to our plant, and during the year increased our line of output by adding two new machines to our list, viz., Nos. 3 and O. O. Radial Drills. We suffered no trouble during the labor strikes of last spring; some items of material are firming up in price, and we believe the value of product will appreciate in due proportion.

The Ball Engine Company, Erie, Pa., write us:

Our business this year has been exceedingly good, our orders being in excess of our capacity, notwithstanding the fact that we have been running night and day. This we attribute to two causes, namely: The improvement of business generally throughout the country, and the growing appreciation of our engines for their unequaled qualities. As the result of our increasing business we have moved into our new shop where we now have increased facilities, having put in a number of new tools with others following.

The Abendroth & Root M'f'g Co. (Wrought Iron Sectional Safety Boilers and Spiral Riveted Pipe), 28 Cliff street, New York, write us:

Our business in general, during the year 1886 has been very satisfactory, the spiral pipe trade being about the same as in 1885, the boiler trade having increased about 100 per cent.; the larger portion of the increase belonging to the last six months of the year. Enquiries in both lines are coming in very plentifully.

We have had no trouble with our labor, nor have there been any changes in wages paid. Raw material was advanced about 10 per cent. In order to keep up with our boiler orders, have found it necessary to enlarge.

The Hendey Machine Co., (Machinist's Tools), Torrington, Conn., write us:

The volume of our business for 1886 has been about twenty five per cent. more than in 1885 and during the last three months particularly we have been very busy. The price of materials (especially pig iron) has advanced materially, but we have not advanced the price of our products as yet, except in one class of machines, though an advance all along the line must follow. During the depression of the last 3 years we made no reduction of wages, consequently we have little to report in that respect, but that little has an upward tendency. We have run full time except a short time early in the year, have added over 15 per cent. to our working force and put in a number of new tools recently, and there are more to follow soon. Enquiries continue brisk, and while people still persist to get rock bottom prices, a large majority of them want "immediate delivery." We have every reason to feel satisfied with the past year and hopeful of the coming year.

The Billings and Spencer Company (Drop Forgings and Drop Forged Tools), Hartford, Conn., write us:

Our business has exceeded that of the year 1885. We have increased our plant in the forging department. A new feature in this department is that of drop forgings of pure copper for electrical purposes. We are now doing a large amount of this work for different manufacturers of electric generators and dynamos. We also have large orders in hand for locomotives and stationary engines, guns, sewing machines, and machinery generally. Our sales for our finished tools have materially increased the present year, especially in the last six months. Prospects for the future look favorable with us for a good year's business.

W. P. Duncan &Co. (Cushioned Hammers, Mining and General Machinery), Bellefonte, Pa., write us:

Replying to your letter of 10th, our business for the past year has been good. November brought a rush of orders from all directions. We are constantly increasing our force and running overtime in all departments. Our sales of "Vulcan" cushioned power hammers are unprecedented. We are working at present on some heavy contracts of rolling mill, and mining, ore washing, and, separating machinery. We have three months' work on our books now, so that the near future to us at least promises a busy time. In this region the activity in the iron business is remarkable and is apparently on a healthy basis. The speculative element not in sight as yet.

The Stiles & Parker Press Co., (Presses, Dies and Tools), New York City and Middletown, Conn, write us:

While the volume of business done by us during the first 9 months of this year was hardly above the average, we have been fairly over-run with work since the beginning of October. We have been running our shop 13 hours each day for the last 3 months, and have still been unable to catch up with our orders, although we have had to refuse short delivery orders all along. We have work enough on hand to last us for several months, and although we do not expect this extraordinary rush to last, we think that everything points towards a very satisfactory business in 1887.

Owing to sharp competition, the margin of profit on our tools is small, but we think that business will warrant an increase in prices, by the time we get our new 200 page catalogue ready for publication, which will be in a few weeks. This catalogue will contain a large number of tools of new design and novel construction, and a very complete list of dies, special tools, etc. Our new toggle joint drawing presses, of which we have now quite a number of styles and sizes ready for the market, fully meet our expectations, and our customers greatly prefer them to the "cam" drawing presses, in point of durability, accuracy and simplicity of construction. We are thinking of enlarging our works at Middletown, but as yet have not fully decided. Our New York branch factory has been busy all the year on dies and special work.

The Cleveland Twist Drill Company, Cleveland, Ohio, write us:

We are selling fully 50 per cent. more goods this year than last, and our orders for reamers and staybolt taps are largely ahead of our present capacity. We have been obliged to add several new machines to our plant during the year, and will make further additions immediately. There is a tendency towards better prices at present, and all things considered the year's business has been very satisfactory to us.

Melvin Stephens (Vises, Attachments and Planer Chucks), 41 Dey street, New York, writes us:

I am able to speak with some degree of satisfaction in regard to my business for the year 1886. It has been steadily progressive from the beginning to the end, and the prospect for the coming year is certainly most encouraging. In proportion to the thrift of manufacturing industry is the demand for additional tools and machinery, and it may truly be said that vises form no inconsiderable part of this demand.

My stock, though very large at the commencement of the year, has since been supplemented, but now it is found so diminished that I shall be compelled to replenish without delay.

The steel bar vises recently introduced are finding much favor in the market, and my patent planer chucks, on account of their excellence as well as cheapness, are increasing in demand. No changes in price, product, or material other than above stated.

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☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

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NEW YORK, JANUARY 15, 1887.

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Mechanical Progress in 1886.

Those who measure mechanical progress only by great strides may not find much to measure during the past year; those who put together small things and sum up the total will be better satisfied. There has not, so far as we know, in this country, been a single company organized to build boilers that make steam without fuel, or heat engines that do work without using heat. This is in itself a matter of congratulation. One reason why such schemes have, to use a society phrase, become unfashionable is that capitalists have been victimized so frequently in the past by their originators that they have suddenly become cautious; another and more potent reason is that general knowledge of engineering and mechanics is increasing year by year, which makes it correspondingly more difficult to sell engineering and mechanical impossibilities. This last reason is a sure sign of mechanical progress; it gives the honest inventor some present and future opp rtunity to work out honest ends.

But while nothing startling has been done in the direction of the steam engine, there is scarcely a builder that has not made improvements of some sort in detail, which help, altogether, to make the steam engine in every way a better machine. Compounding the stationary steam engine has received a good deal of attention during the past year, and both builder and user understand its importance better at the beginning of 1887 than they did one year ago. Several well-known builders that had done little in compounding a year ago, have built a good many compound engines during the past year, and have, we believe, been almost universally successful.

In locomotive engines heavier construction has been the rule for 1886, as in previous years. The weight on drivers has been increased, and apparently with entirely satisfactory results. The results of compounding locomotives, now being tried in England, is watched with interest here, but so far there is little intention of experimenting in that direction.

In boiler work, steel has gained somewhat in popular estimation. This seems to be owing to the fact that steel plate makers are learning how to produce better material, and boiler makers are becoming better acquainted with the best means of working it. This is progress, if it is true, as we believe it is, that steel of a proper quality, properly worked in the shop, is the best material for boilers. For other purposes, such as locomotive axles, crank pins, piston rods, etc., there is yet much difference in opinion as between steel and iron, and nothing material has been done this year to reconcile differences of opinion.

In machine tools, the movement has been towards greater strength and stability; this is clearly seen in such tools as have been brought out from new patterns in 1886. Various improvements in such tools, in minor directions have been made by all prominent builders.

Manufacturers of wood working machinery have been active in improving their products, the result being that several improved, if not absolutely new tools have been added. Here, as in machine tools the tendency has been towards greater strength, in a marked degree.

Progress in the science of electric lighting has not been particularly noticeable, still it will be found that more is known about this means of illumination than was known a year ago. The installation and management of plants for electric lighting is getting to be better understood, and this means cheaper and better light. There has been but little progress in electric motors. Extravagant claims for these motors are about as common as ever, and these claims, known to be untrue, hinder progress. There is room for an electric motor, and when those who are working in that direction learn to put it on its exact merits it will make the headway it is entitled to make.

Those who devote their time to bringing out new appliances of a supplementary character for steam users and mechanics have not been idle in 1886. Many entirely new ones, and many important improvements have been made.

On the whole if the sum of mechanical progress, as made up of everything that tends in that direction, is considered, it will be found that a good deal has been accomplished in 1886.

We publish this week another lot of letters from machinery establishments, in answer to our annual inquiry about the state of business and prospects for the ensuing year. These letters show that the machinery, tool and supply business is in a very good condition, and the prospects quite favorable. None of the writers take a depressed view of the situation. Confidence seems everywhere prevalent. It is quite probable that prices of machinery will advance, and that now is a good time to make purchases of machinery and tools that are needed.

Things We Should Like to Know.

Some of our esteemed contemporaries have recently discovered remarkable efficiency in electric motors, and a corresponding inefficiency in steam and cable transmission. We are in the condition of wanting to know: If steam applied direct is not the most efficient means of propulsion for railroads and railways yet devised? If there are any tests, well authenticated, that show from fifty to sixty per cent., as is claimed, of the engine power utilized in electric motors? If wire rope propulsion does not utilize more than twenty five per cent. of the power of the engine? Mind we do not make any claims in either direction, just now, but are willing to publish exact facts in relation to the matter.

We have frequently called attention, not only to the honor, but to the policy of stating exact facts in regard to the performance of machines and machinery of every kind. Whatever cannot stand on its merits cannot long stand, at all.

Another thing we should like to know is, what new discovery has been made in the direction of the triple thermic motor? The prevailing opinion has been, for some time, that the originators of this scheme had—made a mistake. If new light has been shed upon this defunct motor, it ought to be made manifest.

We do not dispute all or singular the claims made for any of the above devices; we merely ask for the new proof that ought to be forthcoming.

Price of Locomotive Drawings.

One of the many duties which a chief draftsman in a private locomotive shop has to perform is to conduct his department in a manner which will not allow the expenses of the drawing room to run higher than those of other establishments engaged in the same business. His success in this direction will greatly depend upon his own ability, actions and conduct. Of course if he is not a capable and experienced draftsman himself, success will be out of the question. But besides this he must procure competent assistant draftsmen, gain their good will by gentlemanly treatment, and above all the drawings sent into the shop, and his own conduct should be such as will secure for him the confidence and respect of all the foremen in the other departments in the same establishment. The necessity of harmony between the heads of different departments has been recognized by competent managers, and the consequence is that all the expenses connected with the building of a locomotive are considerably reduced.

In private locomotive works having an average run of work during busy times, the cost of drawings in one year will amount to $40 per engine. By "average run of work" we mean various orders each including 10, 20, and up to 40 engines of the same design, but each order calling for a different class of locomotives, and besides these a few orders of one or two engines of an odd design. The cost of $40 per engine will also include the expense of complete sets of drawings for new designs of engines, which in locomotive shops must be occasionally made. The cost of a complete new set of plain, but good working drawings for a locomotive, made under a good management, will be about $1,000, rarely exceeding $1,200.

On the other hand when harmony between the foremen of the different departments does not exist, or when the officers of a company are not acquainted with each other, and each one endeavoring to show to the others the importance of his own position, the expense of building a locomotive, as well as the cost of drawings for the same will be greatly increased. We remember a railroad company which a few years ago concluded to build their own locomotives, and engaged men for this purpose. Some of these were capable men, but all strangers to each other. The result was that the first set of drawings for a locomotive cost a little over $3,500.

What Industry and Perseverance Can Accomplish.

This week we received a call from a young man, who ten years ago joined a public evening drawing school of which Mr. J. G. A. Meyer had charge. The young man's object was to learn practical drawing and machine design, of which he knew nothing; even the drawing pen was a new thing to him. He commenced his studies in earnest, attended all the sessions during three winters, and up to the present time studied early and late. The reward of his industry and perseverance is, at present, a responsible and paying position in a drafting room on one of our prominent Western railroads. Next year he intends to start a business himself with bright prospects before him. He informs us that sober, industrious, and studious young men will, in the Western part of the country, meet with good chances of obtaining paying positions of responsibility. We may add that several other young men who obtained their knowledge of practical drawing in the same public school now hold positions of responsibility within an area of 17 miles around New York city.

Too Much Red Tape.

When the managers of street car railroads progress as far in labor matters as the managers of steam railroads, "tie ups" will be few and far between. When a grievance exists on a steam road the managers are waited on by a committee of the Brotherhood of Locomotive Engineers or Locomotive Firemen, representing the employes, but not themselves employed on the road. The grievances are then discussed, and in about ninety-nine cases out of a hundred a remedy is agreed upon before the committee ceases its work. The old notion that a manager should not recognize a committee of a trade union to discuss labor matters unless the committee is composed of his employes exists only as a relic on steam railroads. On street railroads the notion is quite prevalent, as several thousand people in our large cities have learned within the past few months when obliged to perform involuntary pedestrianism. The science of mutual concessions has made a great deal of progress, but in some quarters it has not been studied much.

Stock Well Watered.

One of our exchanges notes the organization at Portland, Me., of the American Type-Setter Company, "with capital stock of a million dollars and none of it paid in." Probably the first operation will be to sell stock or try to sell it. The company has a full set of officers and directors. A railroad company might be organized with a large capital and none paid in without much suspicion. The "lambs" would just as readily absorb the stock. But a manufacturing corporation will find it hard to float its stock with nothing but water to buoy it up. The law is very liberal in allowing companies to organize with watered stock and to protect the selling of worthless shares. It is too repugnant to public morals to incorporate a lottery, but often the investors in lottery tickets have better security than the purchasers of legalized stock. It is apparent that much better safeguards ought to be provided by law for the innocent purchasers of the stock of incorporated companies.

Offices Needing Skilled Officials.

Kings County, N. Y., which is principally the City of Brooklyn, has an official styled the "County Stenographer." He draws a good salary and to get the office must stand high in a "civil service" examination in party influence. As to knowing anything about stenography that does not seem to be essential, for an individual has just been appointed to the office who knows no more about stenography than the average citizen knows about making out Chinese laundry lists in oriental hieroglyphics. He is, however, a stenographer by title, but not by occupation. Getting the office of City Engineer often requires the same qualifications. If the official appointed knows nothing about engineering work, his lack of knowledge in that line might be covered up. He might act in a nominal capacity while relying upon others to perform the duties. The test of stenographic ability is so simple and direct that a public official could not pretend to possess it without really being qualified, but the city engineer might rely largely upon bare pretense. There is no reason why city governments cannot obtain as competent engineers, if proper salaries are paid, as can private establishments. The obstacles in many instances are that proper salaries are not paid and that a "political pull" is more effective in securing the office than ability to perform the duties required. The result is often a prodigal waste of money in the water, gas, fire and street departments. The remedy ought to be apparent, but instead of applying it, private "syndicates" are often aided by some portion of the press in getting control of the gas and water supply. The people are then imposed upon worse than before. There is a broad field for reform in municipal government, especially where skilled occupations are involved.

A correspondent asks, if the "patent binders" which are intended for temporary use in holding a year's issues of the AMERICAN MACHINIST are any way liable to injure the papers for permanent binding. We answer, no. The binders are useful for keeping the papers neat, clean and all together as they come out during the year, and can of course, be retained permanently, though a regular binding applied by a book-binder is always preferable.

Literary Notes.

ALUMINIUM: ITS HISTORY, OCCURRENCE, Properties, Metallurgy and Applications, including its Alloys. By Joseph W. Richards, A. C., Chemist and Practical Metallurgist, Member of the Deutsche Chemische Geselschaft. Illustrated by Sixteen Engravings. Published by Henry Carey Baird & Co., Philadelphia. Price $2.50.

There is dearth of printed information in the English language relating to aluminium, while there is a lively and growing interest in the production and use of that metal; hence it is safe to predict that the book named above will be well received.

The whole subject appears to be excellently well treated, and is one of the most interesting and, we doubt not, instructive works which has appeared in a long time.

Angus Sinclair has in preparation, and nearly ready for the press, a work entitled "American Railroad Machinery." It will contain a brief historical sketch of the development of the locomotive, followed by engravings of the leading American types, with descriptions and discussion of proportions. There will also be, in connection with this branch of the subject, considerable space devoted to combustion, steam, and the philosophy of locomotive construction and management. In addition to locomotives, the subject of cars will be taken up, with details of the leading types. Wrecking cars, derrick cars and railroad machinery, railroad signals, in fact all leading railroad appliances will be treated.

But few men are as well fitted to write upon these subjects as Mr. Sinclair, who is both theoretically and practically acquainted with all the details. We shall look for the appearance of his book with more than usual interest. The illustrations will, for the most part, be prepared expressly for the work.

The *Electrical World*, of New York, has issued a pamphlet descriptive of its origin and development. The present weekly journal has grown up from the *Operator*, a small semi-monthly sheet started in 1874, its principal resources being, as is frankly admitted, "great expectations." The *Electrical World* may be pardoned all reasonable pride in consideration of its present standing. The pamphlet is illustrated with engravings of the various rooms devoted to the business of getting out the journal, and also with a suggestive picture, under which we read, "The aerial wire question in New York, as viewed from the room of the business manager of the *Electrical World*."

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(11) R. E. A., Birmingham, Ala., writes: To settle a dispute, what is the weight of a cubic foot of water? *A.*—It varies with the temperature. It is commonly taken to weigh 62.42 lbs. at a temperature of 32°, and 59.76 lbs. at 212°.

(12) J. L., Bridgeport, Conn., asks: 1. What saving in fuel is effected by the compound engine? *A.*—Manufacturers of steam engines will generally guarantee from 10 to 30 per cent. 2. How does a compound locomotive carry the water necessary for condensing the steam? *A.*—Compounding does not necessarily imply that the engine is worked condensing. In a compound locomotive the steam is not condensed; expansion is begun in one cylinder and completed in another.

(13) A. L., Quebec, P. Q., asks: With a double engine, 8"x15", cranks at right angles, revolutions 140, cut-off at ¾ stroke, what boiler pressure will be required to develop 20 horse-power? *A.*—If the engine is of good construction, properly piped, you should be able to get 20 horse-power with 35 pounds steam pressure.

(14) A. N. P., Painesville, Ohio, asks: How much soda should I put in a boiler, 4½ feet by 16 feet, to remove grease, which finds its way in by exhausting into an open well, from which the feed-water is taken? *A.*—You can use from four to five pounds at a time, 2. Will it injure the iron? *A.*—No.

(15) W. H. B., New York, sends sketch of a water-line connections, in which the lower, or water pipe, is 2 inches, and the upper, or steam pipe, ¼ inch, and asks if under such conditions the glass will show the water level correct? *A.*—Under ordinary conditions, the water level will show right in the glass, without reference to whether or not one of the pipes is larger than the other. If the boiler is given to priming, the water level may not be correctly indicated. On general principles, the steam connection is not large enough, when considerable length of pipe must be used.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 169 William st., N.Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

N. B. Non-breakable Drills and Taps. A. P. Brown, 108 Liberty st., N. Y.

Solid Nickel-Seated "Pop" Safety Valves. Consolidated Safety Valve Co., 111 Liberty st., N. Y.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

Davis Key-Seating Machines, kept in stock, by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Mechanical and Patent Office Drawings executed at reasonable rates, by A. Mugford, Hartford, Ct.

20", 25," 28" B.G. and S. F. upright drills for immediate delivery. Currier & Snyder, Worcester, Mass.

Ice and Refrigerating Machines. 120 built, and all successful, by David Boyle, 521 Monroe, Chicago, Ill.

The Improved Tabor Steam Engine Indicator, made and sold by The Ashcroft Mfg. Co. 111 Liberty st., N. Y.

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 92 Park row, N. Y.

Curtis Pressure Regulators, Curtis Return Trap. Curtis Damper Regulator. See Jan 8, p. 11. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

Machinists' supplies, brass goods m'f'rs supplies, polishing materials, all kinds wire, metals, etc; in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.

Handbook on the Care of Boilers. 50c. Descriptive Circular and Catalogue of Books for Mechanical Engineers free on application; special terms to Mechanics' Libraries. E. & F. N. Spon, Publishers, 35 Murray st., New York.

"Hints to Steam Users, Engineers and Firemen." A 100-page book on care of steam boilers; just issued; containing useful rules, tables, etc.; a valuable book for engineers; sent on receipt of 25 cts. in stamps. J. N. Mills Pub. Co., 30 Vesey st., N. Y.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

Patent Binders for the AMERICAN MACHINIST, holding a complete volume (52 issues), simple, neat, durable. Price, $1, prepaid, to any part of the United States by mail. To Canada or foreign countries the price will be 75c.; purchasers pay express charges and customs duties. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2 post-paid. Published by John Wiley & Sons, 15 Astor Place, New York.

MANUFACTURES

T. H. Clark & Co., Culpeper, Va., are erecting a new carriage factory.

Daniel & Straus are erecting a mill and gin (not a gin mill) at Lonoke, Ark.

Thos. Hennessy will erect an $11,000 factory at 322 Desplaines street, Chicago.

It is reported that the Colorado Midland will locate its shops at Pueblo, Col.

James T. Halsey has started to build his automatic engines in Richmond, Va.

The Electric Fabric Company will build a large brick factory at Hopedale, Mass.

The Knoxville Car Wheel Company, Knoxville, Tenn., are erecting a boiler shop.

The Montgomery Iron Works, Montgomery, Ala., contemplate erecting a nail factory.

G. W. Wheland will enlarge his foundry and machine shop at Chattanooga, Tenn.

Clara Walters will erect a $35,000 factory on 109th street, near First avenue, New York.

Hammond, Standish & Co. will erect a $10,000 factory on Twentieth street, Detroit, Mich.

The Detroit (Mich.) Steam Radiator Company will erect a two-story manufactory, to cost $22,000.

Eddie & Filson have been awarded the contract for building the Briggs Rolling Mills at Findley, O.

The Delaware, Lackawanna and Western Railroad Company will build a new shop in Utica, N. Y.

A. Tanquerey, 767 De Kalb avenue, Brooklyn, N. Y., will erect a three-story picture factory, 34x30 feet.

The Amherst Drill Press Company, of Havanna, Ill., will erect a two-story brick building for a shop.

McManus Bros., of Philadelphia, will erect a two-story shop at Germantown avenue and Price street.

The Francis Palm's estate in Detroit will erect a five-story brick manufactory, 60x100 feet, to cost $20,000.

T. A. Perry, Plymouth, N. C., is building a new foundry, 30x50 feet. Will be in operation by February 1.

Wm. C. Heppenheimer, 227 William street, New York, will erect a six-story factory, 27x88 feet, to cost $12,000.

Wm. C. Harris, of Mercer, Pa., has been awarded the contract for building the tin plate works in Hubbard, O.

John S. Blackburn, Cleveland, Tenn., will organize a stock company, with $100,000 capital, to build a planing mill.

It is reported that a tube manufacturing company, with a capital of $250,000, is to be established at Newark, N. J.

It is reported that the Cincinnati and Newport Iron and Pipe Company are preparing to double the capacity of their plant.

There is a probability that a stock company will be formed at Newport, N. H., for the manufacture of cotton goods by steam power.

It is reported that a syndicate of Atlanta, Ga., and Richmond, Va., capitalists has been formed to build two 150-ton iron furnaces at Oxanna, Ala.

The Birmingham Axe and Tool Company, Birmingham, Ala.—C. L. Jeffords, manager—will put in a 250 horse-power engine and new tools in their works.

Aikin & Lighton, Birmingham, Ala., will remove their foundry and machine shop to another location. Work on their new buildings will commence in January.

E. Horton & Son, of Windsor Locks, Conn., have bought three $15,000 new and improved chuck machines, one being already in place and the other two on the way.

The American Twist Drill Company, manufacturers of chuck jaws and other machinery specialties, have removed their office and works from Meredith to Laconia, N. H.

The Bouton Foundry Company, of Chicago, has been incorporated. Capital stock, $450,006. Nath'l S. Bouton, Edw. G. Shumway, Frank W. Barker and Carl D. Bradley, corporators.

A syndicate of Boston capitalists has bought the water-power of the Buckingham Manufacturing Company, Ottawa, Canada, and will build works and erect machinery for crushing iron ore.

The Weimer Machine Works Company, Lebanon, Pa., have received the contract to furnish twelve blowing engines for the new furnaces of the Pratt Coal and Iron Company, Birmingham, Ala.

F. W. Gordon, of Gordon, Strobel & Laureau, 226 Walnut street, Philadelphia, Pa., is prospecting at Florence, Ala., with a view, it is said, to erecting an iron furnace.—*Baltimore Manufacturers' Record.*

John S. Perry, of Albany, N. Y., and others have incorporated the Perry Stove Manufacturing Company at South Pittsburgh, Tenn., and let the contract to build the works to Mr. Chandler, of Chattanooga.

The Morgan Iron Works, of New York city, has been incorporated. Capital stock, $40,000. John Roach, 814 East Ninth street, Geo. E. Weed, Garrett Roach, New York city, and John B. Roach, Chester, Pa., corporators.

The Williams Manufacturing Company, of Taunton, Mass., has given up the manufacture of twist drills, but it is expected the business of awls, picker teeth, steel tacks, etc., will be continued to an increased extent.

The Chicago *Industrial World* says: "The Bouton Company have constructed a new and extensive plant at the corner of Archer avenue and Quarry street, and expect to be in running order a little after the first of the year."

The Camden Brick, Machine and Manufacturing Company has been organized at Camden, Ark., with Mr. Drake as president and Mr. Brewster as vice-president. The company have bought the machinery for their works.

All the departments of the new works of the Somersworth Machine Company at Dover, N. H., have been started up with a force of 75 skilled mechanics, which number, it is expected, will be increased at an early day.

The Southwestern Iron Works have been incorporated at Louisville, Ky., to manufacture iron goods, by Alfred Bell, John Speicher, Theo. Ahrens, Sr., Henry Ott, Theo. Ahrens, Jr., and Louis Ahrens. The authorized capital stock is $50,000.

The Dover City (N. H.) Council has voted to exempt for ten years from taxation Clement & Wellington, leather manufacturers, who have leased the Bellamy Mills, they guaranteeing a business exceeding $100,000 annually.

The Riddle Wheel Machine Company—capital stock, $1,000—has been incorporated at Covington, Ky., by W. J. Stephens, Alexander Orr, James M. Ridley, T. W. Powers and R. A. Powers. The company is formed to manufacture machinery for making wheels.

A syndicate of Atlanta and Richmond capitalists has just been formed for the erection of two 150-ton iron furnaces at Oxanna, in the center of the Alabama coal and iron regions, on the crossing of the Georgia Pacific and the East Tennessee roads, adjoining Anniston. These furnaces will cost $380,000. Other large works are also projected.

Williams & Son, soapstone manufacturers, the American Shearer Company, and Fox & Co., furniture makers, have been exempted from taxation by the Nashua (N. H.) city government, for ten years, on whatever they may invest in excess of that invested now. The first concern was burned out some time ago, and the others will build large shops.

The shops of the United States Pump and Valve Company, in Boston, have been completed and machine work begun. The new shops consist of a machine shop of three stories, 105x35; a brass foundry, 30x40; a boiler house, 30x35, with coal sheds, stable, etc. The company will make their fine pumps and valves, and a large line of steam and water-users' goods, prominent among which is the U. S. injector. They will also manufacture the Pearson noiseless steam motor for street railways.

The Syracuse Supply Company, of Syracuse, N. Y., is a new company dealing in machinery tools and factory supplies. Their New York office is with G. T. Moore, 112 Chambers street. The company write us: "We have secured some valuable agencies, such as the Diamond Emery Wheel and Machine Company's, the Grant corundum emery wheel, Kearney & Foot Company's files, Standard Tool Company's goods, twist drills, etc., and others equally important. We are established at 46 West Fayette street, Syracuse, where we have a store 120x26 feet, with excellent facilities for handling our business. We are all young, energetic men, and there will be four of us to canvas trade in our line for a radius of one hundred miles from Syracuse, and hope to merit and obtain a share of the business in that section."

Machinists' Supplies and Iron.

NEW YORK, Dec. 30, 1886.

It is not to be expected that there will be any new developments in trade during the holiday season. In that respect this year will not differ from its predecessors.

Iron—The same firm feeling in the future of American pig prevails. Furnacemen are not inclined to sell for future delivery without considerable advance on present prices. Standard brands of No. 1 X Foundry sell at $21 to $21.50; No. 2 X, $19 to $20; Grey Forge, $17 to $17.75.

Scotch pig is held firm, at prices of one week ago, with slight advances in some brands. We quote Coltness, $22.50; Glengarnock, $20.50; Summerlee, $21 to $21.50; Eglinton, $19.75 to $20.25; Langloan, $21.50 to $22; Dalmellington, $20.50.

Lead—The market is quiet, with sales at 4.30c.

Antimony—Hallett's, 8c.; Cookson's, 9c.

Copper—Lake is quoted at 12c., but has been bought ⅛c. lower; Arizona brands have sold at 11c. to 11¼c.; Baltimore, 10¾c.

Spelter—Refined, 5¾c. to 6c.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

A technical graduate desires position as draftsman; references. Address F. H., AM. MACHINIST.

First-class machinist desires situation as foreman in manufacturing concern or small machine shop; good reference; village preferred. G., AM. MACH.

Position wanted by a successful designer of special machinery; excellent references. Address A. M., AM. MACHINIST.

Wanted—Situation as foreman in foundry doing engine and machinery castings; best of reference. Address J. H. T., AM. MACHINIST.

A young man of good abilities, skilled designer, at present chief draftsman of a machine concern, desires a position as assistant superintendent. Address C. A., AM. MACHINIST.

Wanted—A young mechanical Engineer, whose tastes incline toward marine work; must be able to make working drawings, indicate engines, etc.; the right man would gain a good position in time. Address Bridge, AM. MACHINIST.

Wanted—Foreman for small factory; must understand the manufacture of small tools for the hardware trade, and be able to get up tools for the quick production of the same. Address, stating age, experience and wages expected, Box 12, AM. MACHINIST.

Wanted—Foreman for iron and brass foundry employing about 35 men; cored work largely; must be economical, strictly temperate, and able to manage men well; state wages wanted, and give references. Address "Core," AM. MACHINIST.

Wanted—A man as foreman of a foundry on agricultural and job castings: must be perfectly competent to take full charge of same, familiar with the Colliau cupola and melting with coke; also willing and able to solicit contract work. Address, with references, stating age and salary expected. The Victor Mower Co., Valatie, N. Y.

✢ MISCELLANEOUS WANTS. ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Crescent steel tube scrapers are unquestionably the best. Crescent Mfg. Co., Cleveland, Ohio.

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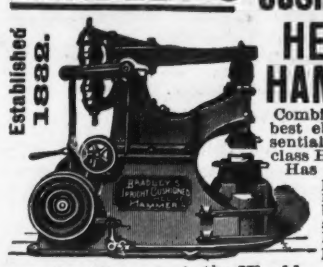

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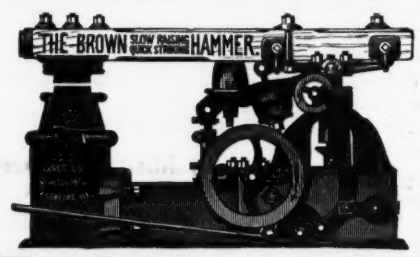

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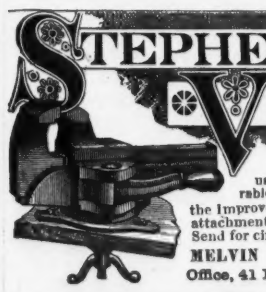

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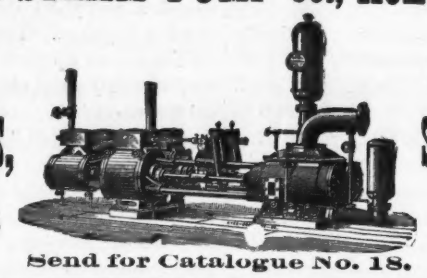

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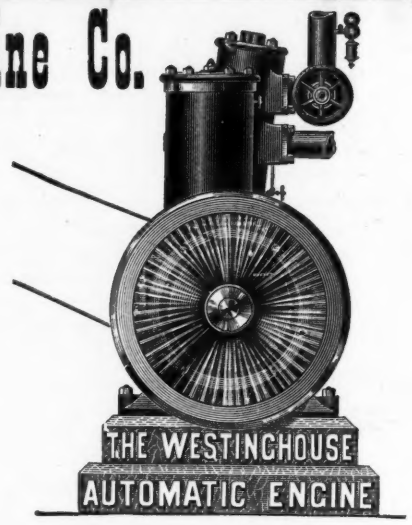

Sales List for November, 1886.

			H.P.
South Side E. L. Co.		Pittsburgh, Pa.,	150
" "	2d order,	" "	150
Union Switch and Signal Co.	6th order,	" "	75
East End E. L. Co.	2d order,	" "	75
" "	3d order,	" "	75
Brush E. L. Co.	2d order,	Buffalo, N. Y.,	60
McConway & Torley,	2d order,	Pittsburgh, Pa.,	60
Winona Paper Co.	4th order,	Holyoke, Mass.,	60
N. Y. & Manhattan R. E. Co.		New York,	60
Mather Electric Co.		Hartford, Ct.,	60
" "	2d order,	" "	60
Jefferson City E. L. Co.		Jefferson City, Mo.	60
Wahoo E. L. Co.		Wahoo, Neb.,	60
J. C. Livingston & Co.		Little Falls, N.Y.,	45
Weidman Silk Dyeing Co.,		Paterson, N. J.,	45
Miller, Broudy & Co.		Alexandria, La.,	45
E. L. McLain Mfg. Co.,	2d order,	Greenfield, O.,	45
Van Deventer & Horne		Plainfield, N. J.,	35
"The Public Ledger"	2d order,	Philadelphia, Pa.,	35
" "	3d order,	" "	35
" "	4th order,	" "	35
" "	5th order,	" "	35
E. Balbach & Son	14th order,	" "	35
Wolff & Hamaker		Chambersburg, Pa.	35
Imperial Guano Co.		Norfolk, Va.	35
Chandler & Price		Cleveland, O.,	35
Wabash, St. L. & Pacific R. R.	2d order,	Ft. Wayne, Ind.,	35
Barnes Bros.		Maquoketa, Ia.,	35
A. J. Mullen.		Selma, Ala.,	35
Brainard & Shephard		Albany, N. Y.,	25
Henry Warden.		Philadelphia, Pa.,	25
Crown Mills		Marcellus, N. Y.,	25
S. R. Cain		Bristol, Vt.,	25
Wabash, St. L. & Pacific R. R.	3d order,	Ft. Wayne, Ind.,	25
Minneapolis G. L. Co.		Minneapolis, Minn.	25
" "	2d order,	" "	25
Thos. Henshall.		Paterson, N. J.,	15
E. Balbach & Son	15th order,	Newark, N. J.,	15
Gas Engine & Power Co.		New York,	15
Roulleaux, Dugage & Co.	2d order,	Suresnes, Fr.,	15
Shickle, Harrison & Howard	2d order,	St. Louis, Mo.,	15
McCord, Ford & Co.		Colfax, W. T.,	15
Decatur Furnace Co		Decatur, Ala.,	15
Lawr'ce Mach. Shop,	15th order,	Lawrence, Mass.,	10
" "	16th order,	" "	10
N. W. Wait, Son & Co.		Sandy Hill, N. Y.,	10
F. S. Cole		Grundy City, Ia.,	10
Union Pacific R. R.	2d order,	Omaha, Neb.,	10
Geo. C. Howard.		Philadelphia, Pa.,	5
Merritt W. Burwell.		New Haven, Ct.,	5
Westinghouse Electric Co.	3d order,	Pittsburgh, Pa.,	5
Lawr'ce Mach Shop,	17th order,	Lawrence, Mass.,	5
" "	18th order,	" "	5
J. A. Diamond		Indianapolis, Ind.,	5
F. J. Yandle		Santa Rosa, Cal.,	5
Aberdeen Packing Co.		Astoria, Or.,	5

TOTAL, 56 ENGINES. 1975

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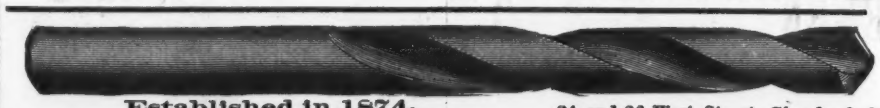

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" " " " 5, " " " 14, 15, 16 "

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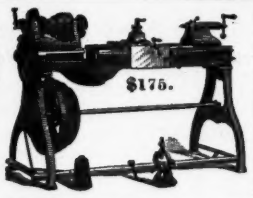

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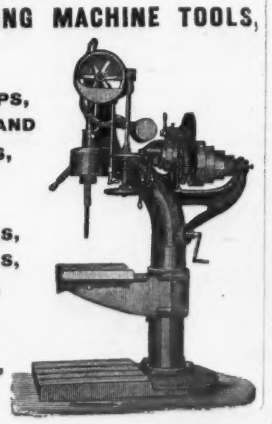

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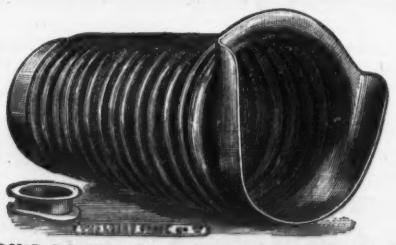

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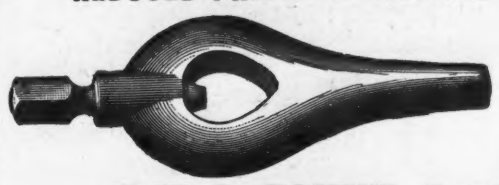

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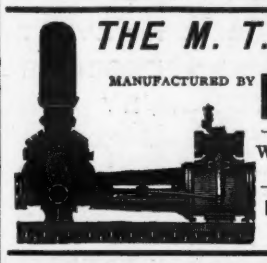

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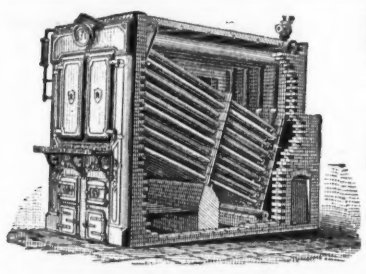

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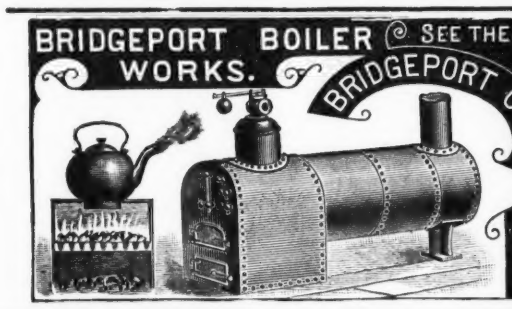

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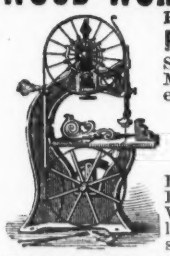

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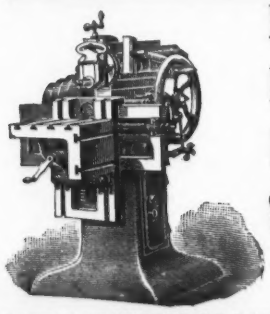

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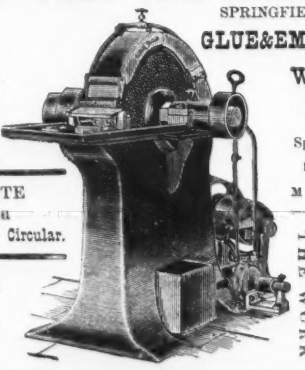

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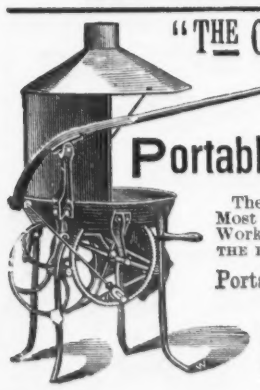

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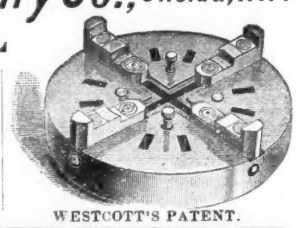

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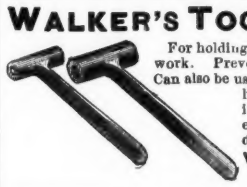

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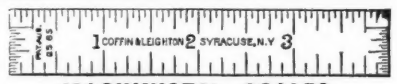

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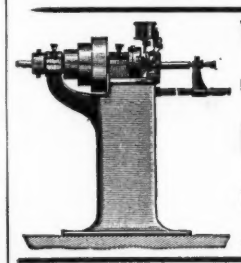

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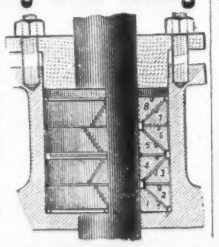

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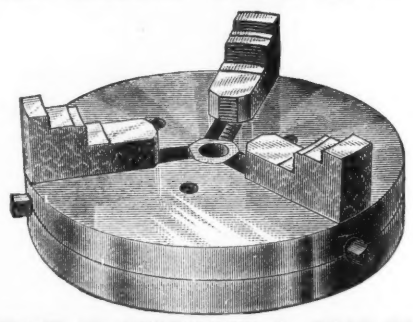

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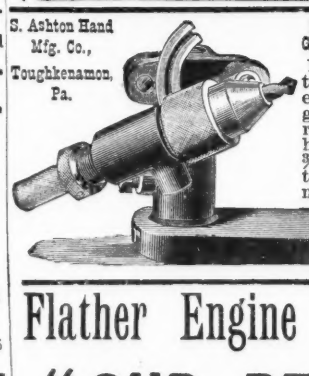

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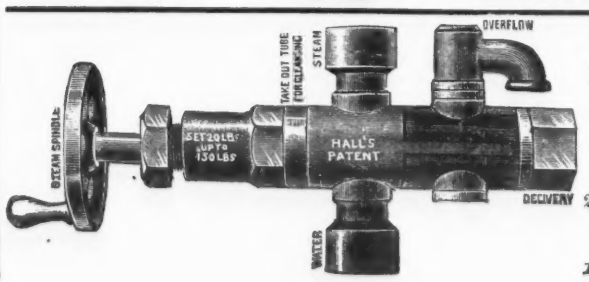

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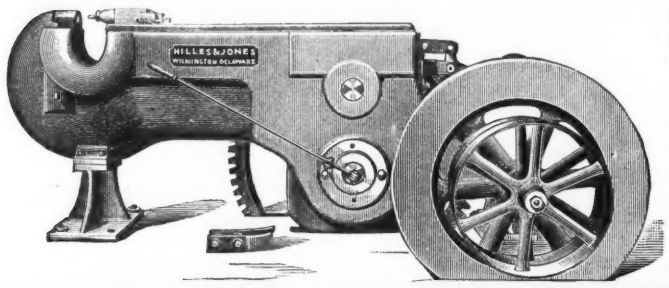

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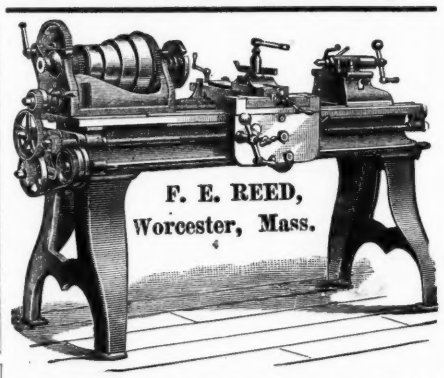

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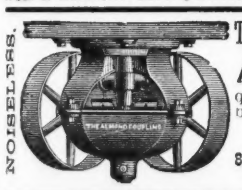

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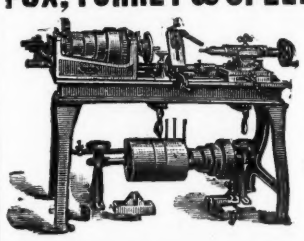

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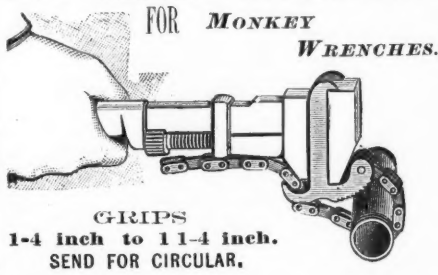

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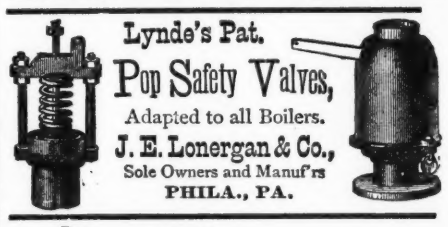

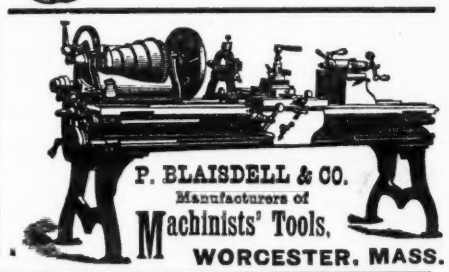

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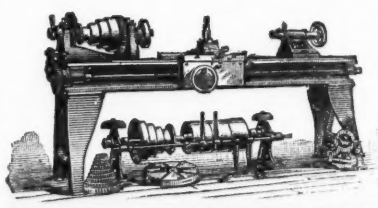

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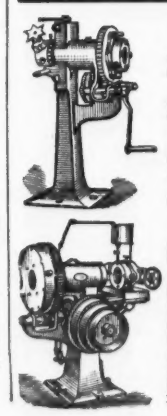

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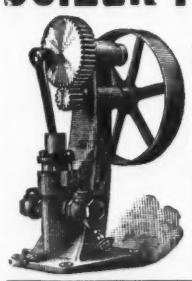

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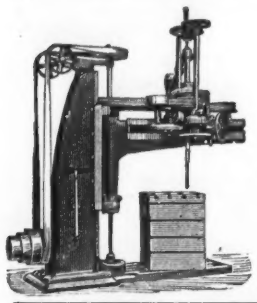

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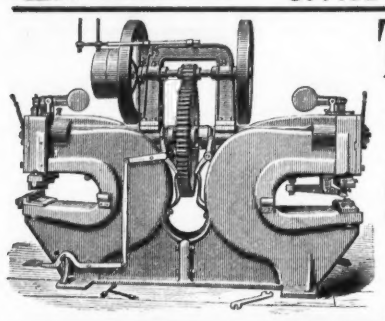

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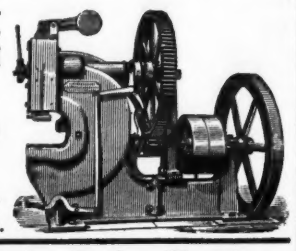

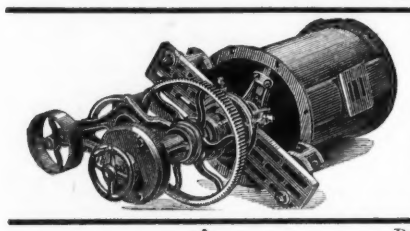

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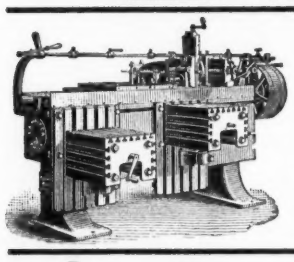

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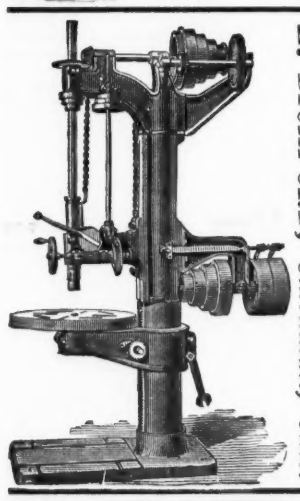

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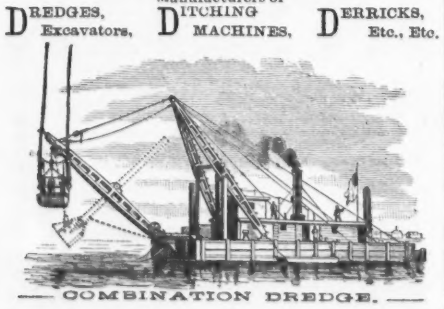

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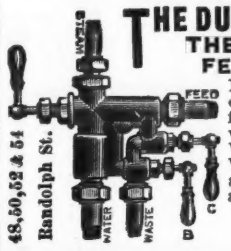

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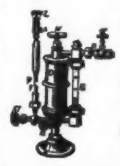

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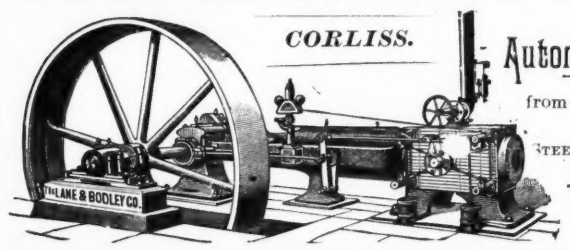

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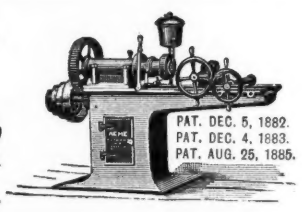

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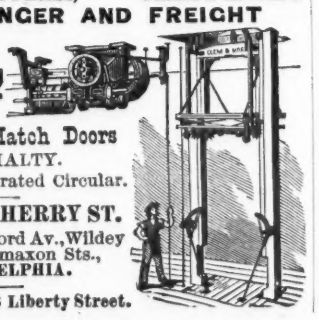

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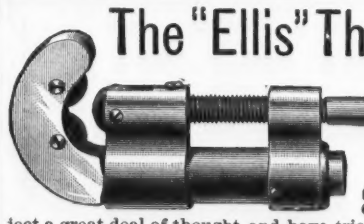

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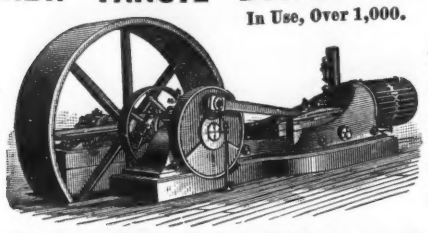

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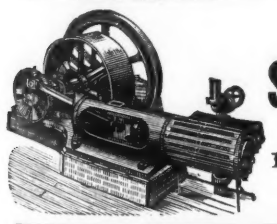

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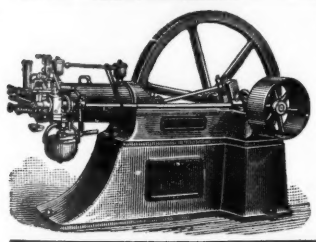

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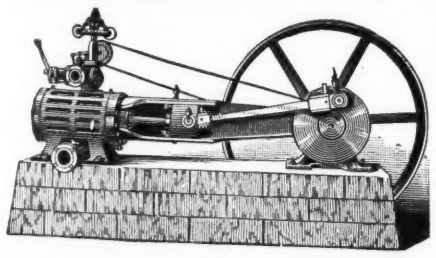

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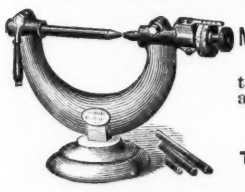

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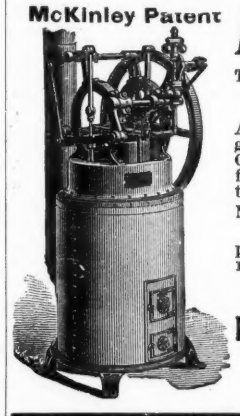

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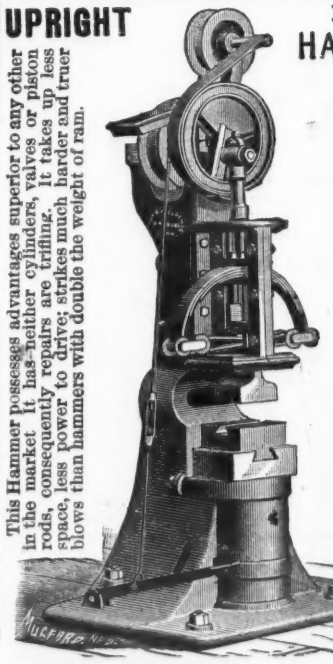

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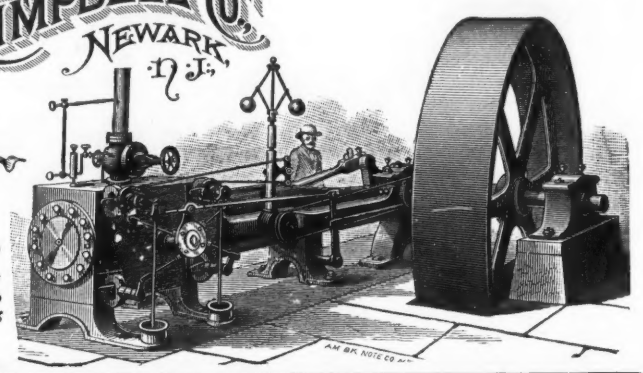

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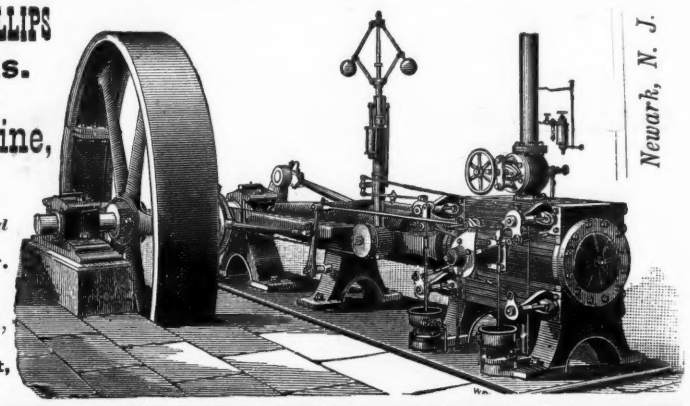

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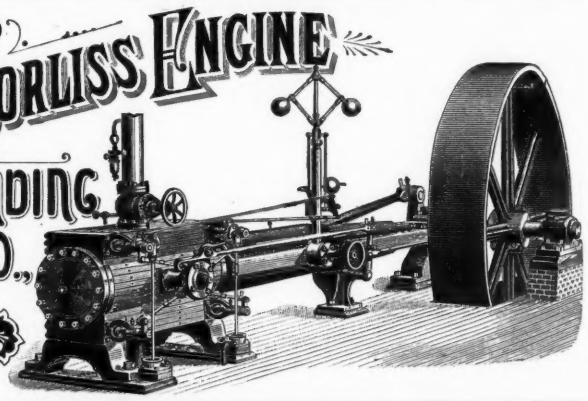

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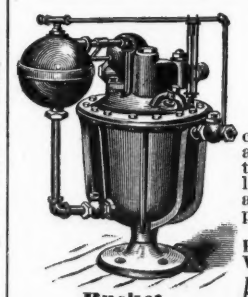

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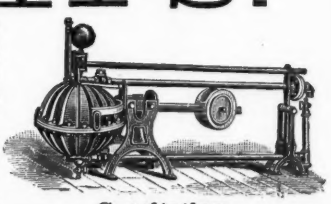

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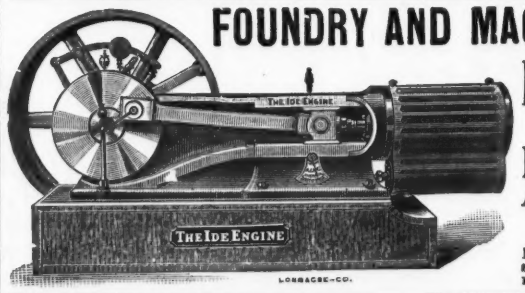

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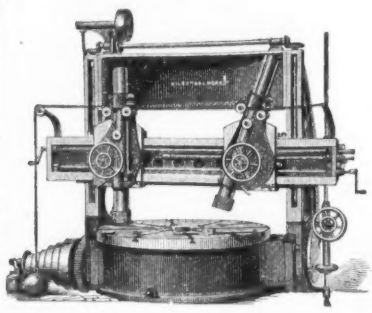

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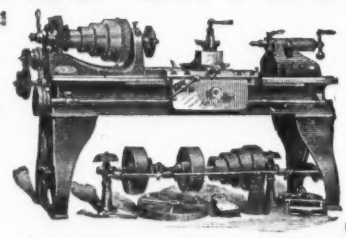

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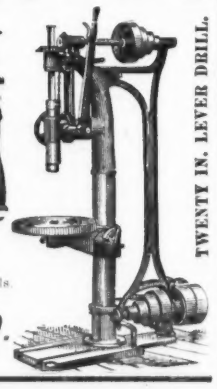

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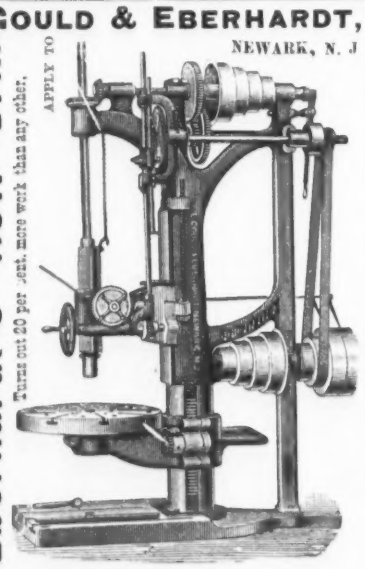

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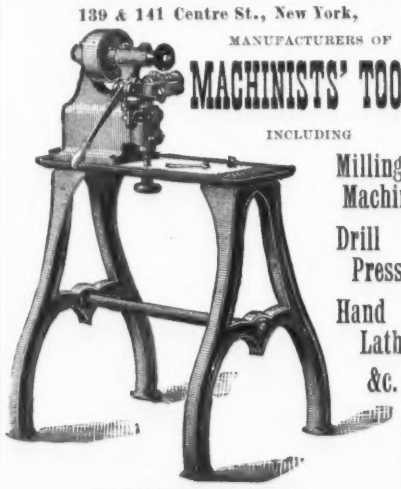

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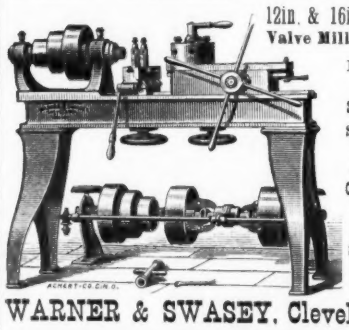

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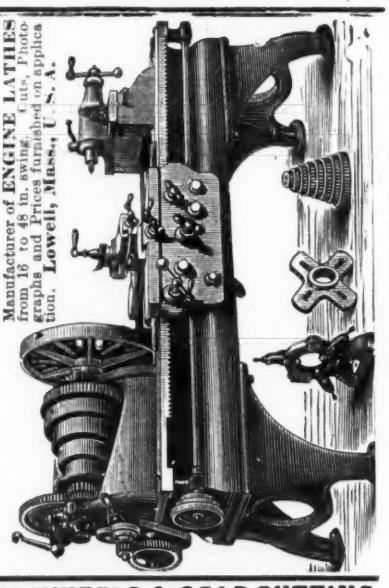

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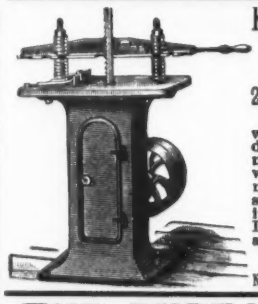

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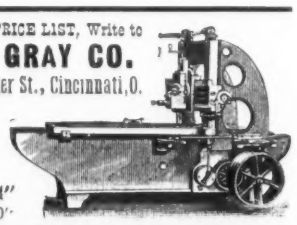

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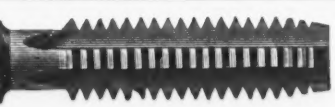

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